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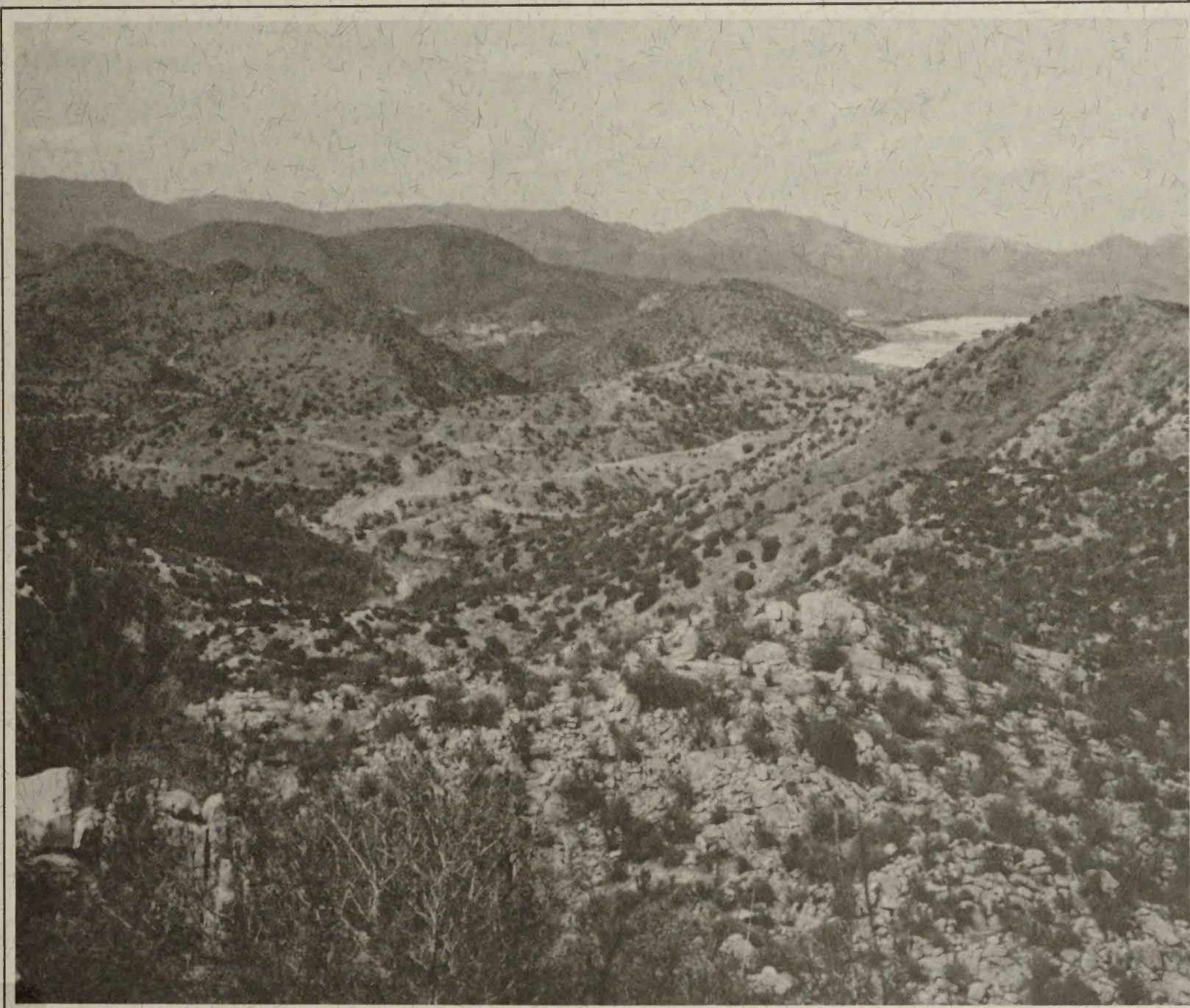
July 1997

From G. L. T.
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4/99

Final Environmental Impact Statement for Carlota Copper Project

Tonto National Forest

Volume I



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FINAL ENVIRONMENTAL IMPACT STATEMENT CARLOTA COPPER PROJECT

Type of Action: Administrative

Lead Agency: USDA Forest Service, Tonto National Forest

Responsible Official: Charles R. Bazan, Forest Supervisor

Cooperating Agencies: Arizona Department of Environmental Quality
U. S. Army Corps of Engineers

EIS Contact: Paul Stewart
Carlota Project Coordinator
Tonto National Forest
2324 East McDowell Road
Phoenix, Arizona 85006
(602) 225-5200

ABSTRACT

The Carlota Copper Company has proposed to construct, operate, and reclaim the Carlota Copper Project, an open-pit copper mining and processing facility located about 6 miles west of Miami, Arizona. Of the approximately 3,050 acres of unpatented and patented lands in the project area, the proposed action would disturb approximately 1,428 acres. The proposed action would involve mining using conventional techniques, including blasting, truck hauling from the pit to the crusher, and conveyor transport from the crusher to the leach pads. Approximately 100 million tons of ore would be mined from the Carlota/Cactus, Eder North, and Eder South pits (including the small Eder Middle pit). The pits would be partially backfilled with mine rock; additional mine rock would be placed in one of three disposal areas. A diversion would be constructed in Pinto Creek to route the stream around the Carlota/Cactus pit. The leach pad (capacity of approximately 100 million tons) would be located in Powers Gulch; the leach pad would also require a stream diversion. Ore processing would include "curing" with sulfuric acid and leaching to produce a copper-bearing solution. The acid (raffinate) solution would be applied to the pad, collected in an internal pond, and then piped to the solvent extraction/electrowinning (SX/EW) plant for production of high quality copper cathodes. The SX/EW plant would have a design flow rate of approximately 6,000 gallons per minute (gpm). An estimated 900 million pounds of copper would be produced.

An average of 590 gpm of water would be required for the operation, with a peak average demand of approximately 850 gpm during the dry months. The proposed water sources would be ground water supply wells in the Pinto Creek drainage and pit dewatering. Additional project facilities would include access and haul roads; power lines; equipment maintenance shop and warehouse; office and laboratory buildings; water, fuel, and reagent storage tanks; and sewage treatment/disposal systems.

Project construction is scheduled to begin in 1997 and employ approximately 177 workers over an 8- to 10-month period. Commercial production of copper would begin in 1998 with an operational workforce averaging 255 to 282 and peaking at approximately 300. The mining operation would continue for approximately 15 years, followed by an additional 5 years of leaching. Mine closure would be complete within 2 to 3 years after completion of operations and reclamation.

The Final Environmental Impact Statement (EIS) analyzes the environmental effects of the Carlota Copper Project. In addition, impacts are discussed for the no action alternative and alternatives involving differences in mine rock disposal areas, the leach processing location, water supplies, and water supply well field access roads.

Agency Preferred Alternative: The Forest Service has selected Carlota's proposed action, as summarized above, as the agency preferred alternative with the following modifications:

- Inclusion of the alternative of additional backfill of the Eder South pit
- Inclusion of the water supply alternative of a combination of low-quality water, water supply wells, and dewatering wells
- Inclusion of the access road alternative A in place of the proposed access road to provide secondary access from the north to the well field

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Summary

The Carlota Copper Company (Carlota) has proposed to construct, operate, and reclaim the Carlota Copper Project, an open-pit copper mining and processing operation located approximately 6 miles west of Miami, Arizona. Carlota submitted a Plan of Operations and a subsequent Update to the Plan of Operations to the Tonto National Forest for its review. The Tonto National Forest management determined that the proposed action had the potential to result in significant environmental impacts; therefore, preparation of an environmental impact statement (EIS) would be necessary. The Forest Service is serving as the lead agency for preparing the EIS, and the U.S. Army Corps of Engineers (COE) and the Arizona Department of Environmental Quality (ADEQ) are cooperating agencies.

Carlota will require a Clean Water Act (CWA) Section 404 Permit from the COE prior to disturbing waters of the U.S. or jurisdictional wetlands. The COE review of Carlota's Section 404 Permit (i.e., the decision to issue or deny the permit) will be based on the impact assessment in this EIS and the public interest review.

This EIS describes the direct, indirect, and cumulative impacts on environmental resources for the proposed action and alternatives to the extent necessary to determine if the impacts would be significant. The analyses described in this document will be the basis for a decision regarding the proposed action or alternatives and the selection of appropriate monitoring and mitigation measures.

Summary of the Proposed Action

The proposed action would involve open-pit mining using conventional techniques, including blasting, truck hauling from the pit to the crusher, and conveyor transport from the crusher to the leach pads. The Carlota and Cactus deposits, which contain approximately 81 million tons of ore, would be mined as a single pit. A diversion would be constructed to reroute Pinto Creek around the pit. Mine rock from this pit would be deposited in the Main mine rock disposal area located northwest of the pit and the Cactus Southwest mine rock disposal area south of the pit. In addition, mine rock would be used to partially backfill the Carlota/Cactus pit. Approx-

imately 19 million tons of ore would also be mined in the Eder pits (North, South, and a small Middle pit) during the latter half of the project; mine rock from these pits would be hauled to the Eder mine rock disposal area located between the Eder North and South pits.

Processing would consist of crushing facilities, a heap-leach pad, and solvent-extraction/ electrowinning (SX/EW) processes. The primary crushing facilities, located north of the Carlota/Cactus pit, would have a capacity of at least 7 million tons of ore per year. An overland conveyor would transport the ore to the coarse-ore stockpile and secondary crusher. A portable crusher would be temporarily located at the mouth of the Eder South pit. Crushed ore from the Eder pits would be transported to the leach pad by truck or conveyor.

The heap-leach pad (with a capacity of at least 100 million tons) would be located in Powers Gulch. The Powers Gulch drainage would be rerouted around the leach pad via an inlet control structure and a diversion channel. Ore processing would include curing the material with sulfuric acid and leaching it to produce a copper-bearing solution. The raffinate (barren solution) would be applied to the leach pad, collected in an internal pond, and then piped to the SX/EW plant, which would produce high-quality copper cathodes.

The water supply requirements for the proposed action would be an average of 590 gallons per minute (gpm) with a peak average demand of approximately 850 gpm during the dry months. The proposed water sources would be ground water supply wells in the Pinto Creek drainage and dewatering water from the pits. The well field would encompass up to five wells.

Additional project facilities for the proposed action would include access and haul roads; power lines; an equipment maintenance shop and warehouse; office and laboratory buildings; water, fuel, and reagent tanks; and sewage treatment/disposal systems. The proposed project facilities would disturb approximately 1,428 acres of National Forest and patented land.

Reclamation activities would include closing the leach pad in compliance with federal and state regulations, removing structures, stabilizing pits (including partial

backfilling of the Carlota/Cactus and Eder pits), protecting natural stream channels and diversion channels, and recontouring and revegetating disturbed areas.

Project construction is scheduled to begin in 1997 and would employ approximately 177 workers for 8 to 10 months. Project operations would commence in 1998 with an operational workforce averaging 255 to 282 and peaking at approximately 300. Mining is scheduled to conclude in approximately 15 years, leaching of the ore would continue for up to an additional 5 years, and mine closure would be completed within 2 to 3 years following the end of operations and reclamation.

Project Alternatives

Project alternatives were selected for analysis in the EIS on the basis of specific criteria:

- Public or agency issue or concern
- Ability to meet project purpose and need
- Technical or economic feasibility
- Potential environmental advantage over the proposed action

The alternatives analyzed in this EIS are described in detail in Chapter 2, Alternatives Including the Proposed Action. An additional alternatives analysis, addressing the CWA Section 404(b)(1) Guidelines, is included in Appendix A, Clean Water Act Section 404(b)(1) Alternatives Analysis.

Mine Rock Disposal Alternatives

Three mine rock disposal alternatives were analyzed in the EIS. These alternatives were developed in an attempt to locate disposal areas on previously disturbed and/or private lands. These alternatives include (1) using two additional disposal areas for mine rock from the Carlota/Cactus pit (Cactus South and Cactus Central sites), (2) additional backfilling of the Carlota/Cactus pit, and (3) additional backfilling of the Eder South pit.

Eder Side-Hill Leach Pad Alternative

An alternative leach pad location, which was considered the most feasible site for avoiding Powers Gulch, a water of the U.S., was defined and analyzed. The Eder side-hill leach pad would comprise two separate pads with embankments located on the east and west sides of Powers Gulch. This alternative would require relocating the Eder mine rock disposal area.

Water Supply Alternative

The alternative water supply analyzed in the EIS would involve piping and using low-quality water from other existing operations, water supply wells, and pit dewatering wells. This alternative would reduce the amount of fresh water required from the water supply wells.

Alternative Water Supply Well Field Access Roads

The EIS considered two alternative routes to access the water supply wells from the north. Alternative A would involve upgrading the existing road within the Pinto Creek channel; Alternative B would follow Forest Service Road 287 west from the Iron Bridge, south and east along Fifty Dollar Spring to well site TW-3 and the existing road. The proposed route, Alternative A, and Alternative B would follow the same alignment between well sites TW-3 and TW-1.

No Action Alternative

This alternative would preclude the development of the Carlota Copper Project on the public lands in question; the ore reserves in the area would remain undeveloped. The no action alternative assumes the continuation of the existing conditions in the project area.

Summary of Impacts

Detailed analyses of potential impacts and mitigation measures for each resource are presented in the environmental consequences sections in Chapter 3, Affected Environment and Environmental Consequences.

The following information provides a summary of potential impacts, by resource, that would result from implementing the proposed action and alternatives.

Proposed Action

Air Resources

The primary project emissions would be process dust (e.g., dust from the crushing and conveying systems) and non-process dust (e.g., dust from materials handling, blasting, and the transport of ore and mine rock along unpaved haul roads). Dust is quantified as particulate matter less than 10 microns in diameter (PM_{10}). Emissions from the combustion of fossil fuels in vehicles, the hot water heater, and the backup diesel generators include PM_{10} , oxides of nitrogen (NO_x), sulfur dioxide (SO_2), carbon dioxide (CO_2) and volatile organic compounds (VOCs). VOCs also would be emitted from petroleum storage.

Based upon the air quality impact analysis, emissions of PM_{10} , NO_x , SO_2 , and CO from the proposed Carlota Copper Project are not expected to exceed the National Ambient Air Quality Standards (NAAQS) at the limits of public access, in the Class I Superstition and Sierra Ancha Wildernesses, or the Class II Tonto National Monument. In most cases, expected emissions from the proposed project represent a fraction of the existing background concentrations. Carlota would implement a variety of control measures to minimize dust and other combustion-related emissions. To meet a requirement in the ADEQ Air Installation Permit, Carlota would monitor PM_{10} impacts to demonstrate compliance with the PM_{10} NAAQS. A Conformity Determination prepared in February 1996 demonstrated that the proposed Carlota Copper Project would conform with the applicable PM_{10} State Implementation Plan (SIP).

Octane emissions are estimated as 0.4 percent of total VOC emissions from the facility and are

expected to be less than 5 tons per year. The estimated 1-hour and 24-hour impacts from octane emissions are significantly below the corresponding Arizona Air quality Guideline (AQG) values. In addition, predicted maximum concentrations of trace metals in particulate emissions from the project, combined with the background concentrations, do not exceed the AQGs.

The proposed Carlota Copper Project would be a source of sulfuric acid (H_2SO_4) mist emissions, an Arizona listed air toxin. Potential sources of H_2SO_4 emissions include the tank house of the SX/EW plant, the ore preconditioning system, and the H_2SO_4 raffinate solution application on the leach pad. The facility is predicted to emit 5 tons per year of H_2SO_4 . Based upon the air quality impact analysis, emissions of H_2SO_4 from the proposed Carlota Copper Project are not expected to exceed the Arizona AQGs at the limits of the project boundary. Therefore, H_2SO_4 impacts to residents of the Top-of-the-World are not anticipated.

The Sierra Ancha Wilderness and the Tonto National Monument are physically protected from visibility impacts caused by the project's emissions. However, the results of modeling indicate a potential for perceptible visibility impacts to occur in the Superstition Wilderness from the Carlota Copper Project emissions. Any perceptible visibility impacts would exceed the Tonto National Forest's visibility objectives for a Class I wilderness areas. The Forest Service and Carlota worked together to evaluate and select mitigation measures to be employed to reduce emissions in order to reduce (or eliminate) the number and magnitude of predicted visibility impacts. Based on an assessment of the effectiveness and economic cost of each of the mitigation measures, Carlota agreed to implement three of the mitigation measures that were evaluated: (1) using newer engines in the large haul trucks, (2) eliminating the haul from the crusher to the leach pad, and (3) augmenting water application rates on the main unpaved haul roads (AEC 1996e). By implementing these mitigation measures, the number and magnitude of potential visibility impacts associated with the project would be substantially reduced, as reflected in the model results.

Based on the results of the visibility analysis and given the technical limits, conservative nature, and

uncertainties associated with visibility modeling, the Forest Service developed a monitoring strategy designed to ensure that emissions from the Carlota Copper Project would not adversely affect visibility resources within the Superstition Wilderness. A complete description of the monitoring plan is contained in Section 3.1.4, Air Resources - Monitoring and Mitigation Measures.

Geology and Minerals

The proposed Carlota Copper Project would disturb approximately 1,428 acres of surficial materials associated with the project components. Approximately 211 million tons of mine rock would be relocated to mine rock disposal areas or used as backfill for the pits. An estimated 100 million tons of spent ore would be left in the closed and reclaimed heap-leach facility. Approximately 900 million pounds of copper would be extracted from the geologic resource.

Relatively low risks would exist for potential damage to facilities from major landslides, slope instability, pit wall instability, and seismicity. Moderate risks would exist for the leach pad liner to settle because of subsidence in the area beneath the heap. These risks would be minimized by following the required design and construction procedures. There would be a moderate potential for temporary increased sedimentation in Pinto Creek from constructing the water supply access road in relatively steep terrain. Sections 3.2.2 and 3.2.4 provide details specific to potential impacts and associated mitigation, respectively, for this resource.

Water Resources

Ground water withdrawal caused by proposed mine dewatering and well field development would create cones of depression that would potentially affect water resources in the area. Potential effects include (1) a decline in water levels in bedrock water supply wells located in the vicinity of the open pits, (2) a reduction or elimination of flows in some natural springs, (3) a reduction in surface flow and alluvial underflow in Haunted Canyon and Pinto Creek, and (4) pit lake water losses caused by evaporation.

A comprehensive ground water and surface water monitoring program would be established to measure

the rate of expansion of the cone(s) of depression and changes in spring and streamflows. A detailed plan to mitigate impacts from well field pumping on streamflows in Haunted Canyon and Pinto Creek has been agreed to by the Forest Service, ADEQ, Arizona Department of Water Resources, Salt River Project, COE, and Carlota (see Appendix E). The Wellfield Mitigation Program is designed to maintain aquatic and riparian resources at pre-project levels, and specifies a mechanism to supplement streamflows. In addition, water conservation measures would be implemented to minimize the quantity of ground water pumped from the well field. Significant impacts to Pinto Creek from pit dewatering activities are not anticipated. The mitigation for any affected spring would vary depending on the ecological value of the resource, and may include supplementing flows in affected streams and springs or implementing riparian improvement projects.

The water levels in the alluvial aquifers would rapidly recover following the cessation of mining. It is reasonably foreseeable that deep aquifers would eventually recover, although the recovery period cannot be reliably predicted. The Carlota/Cactus pit would eventually fill to an ultimate depth of approximately 500 feet from precipitation runoff and ground water seepage. The elevation of the lake surface would be approximately 150 feet below the level of Pinto Creek, which would prevent outflow into Pinto Creek. After the lake fills, an estimated 480 acre-feet per year would be lost through evaporation off the lake surface. Based on predictive modeling, the final pit water quality would be non-acidic, and no adverse impacts to surface or ground water quantity are anticipated.

The heap would be designed as a zero-discharge facility (see Section 2.1.3). The heap-leach facility, operating in conjunction with the inlet control structure and the Powers Gulch diversion, would be designed to completely contain (with 3 feet of remaining freeboard as an additional safety factor) the maximum operational water storage requirement occurring during a wet month in a wet year in addition to the runoff from a one-half probable maximum flood (1/2 PMF) event occurring on the pad, plant, and contributing watershed area. Under these conditions, the potential for process water overflow is considered minimal. The heap-leach facility would also be designed to prevent seepage.

Although an accidental release of process solutions from the heap-leach facility is unlikely during operation, any release to the environment would result in impacts to localized surface water and ground water quality. A release of fluids following closure would also adversely impact surface and ground water. Potential impacts during operation and closure would be monitored to detect any adverse change in water quality and to evaluate the potential contaminant source if degradation of water quality is detected. These activities would be followed by correcting the release source and remediating contamination, if necessary.

The preliminary design for the Pinto Creek diversion would have an alignment similar to the existing channel and would not cause a major change in the channel slope. During operations, such a channel system would continue to function with little change in the hydraulic regime. However, overtopping of the diversion during large flood events would temporarily reduce the flow of water to the downstream portion of Pinto Creek, creating a minor adverse impact. With mitigation consisting of a suitable detailed design and implementation for both the operational and long-term postmining conditions, the channel hydraulics and sediment transport conditions of Pinto Creek would remain relatively unaffected.

The preliminary design for the Powers Gulch diversion would function adequately with inspection and maintenance during operations. The possibility of long-term, postmining failure would remain after reclamation and closure. This would create adverse impacts if the leach pad were exposed to channel flows and accelerated erosion. With mitigation consisting of suitable detailed design, implementation, and monitoring for both the operational and long-term postmining conditions, such impacts might be minimized.

The construction of the mine rock disposal areas, pits, and heap leach facility could result in a temporary decrease in average annual watershed runoff of approximately 171 acre-feet, or 3.7 percent, in Pinto Creek immediately below the confluence of Haunted Canyon. Following project closure and reclamation, this effect would be reduced to less than 70 acre-feet, or 1.5 percent. This impact would occur primarily during storm events.

For the overall project, the predicted increases in sediment yield to Pinto Creek and Powers Gulch would be minor. Best Management Practices (BMPs) would be employed to minimize both short-term and long-term erosion and sedimentation. The predicted increase in sediment yield (before implementation of BMPs) just downstream of the Pinto Creek/Haunted Canyon confluence would be approximately 2 percent. Temporary, localized increases in suspended sediment would occur at considerably higher levels. In addition, approximately 39 acres of alluvial floodplain would be permanently removed from Pinto Creek and Powers Gulch. Direct impacts to other floodplain areas are not anticipated.

A comprehensive discussion of these impacts and mitigation measures is provided in Sections 3.3.2 and 3.3.4, respectively.

Soils and Reclamation

Soils located on approximately 1,428 acres would be disturbed by the proposed action. Most of the disturbance (1,207 acres) would be caused by excavation and other earthwork. Implementation of the proposed reclamation plan would result in soils being redistributed on approximately 270 acres; reseeding without topsoil would occur on approximately 447 acres affected by earthwork. In addition, approximately 221 acres of buffer strips and staging areas would be revegetated. There would be a long-term loss of soil productivity on approximately 490 acres. The estimated postdisturbance soil erosion would be 20 to 30 tons/acre/year on the leach pad sideslopes and approximately 4.9 tons/acre/year on sideslopes for all other project components. Postdisturbance erosion rates would be less than 1 ton/acre/year on the top surfaces for all project activities (see Section 3.4.2). Postreclamation inspection and maintenance would be required to ensure the success of reclamation (see Section 3.4.4).

Terrestrial Biology

Mining would directly impact approximately 791 acres of interior chaparral, 7.14 acres of mesic chaparral, 488 acres of dry-slope desert brush, 118 acres of juniper/grassland, 21.86 acres of riparian deciduous woodland vegetation, and 2 acres of rock outcrop. The loss of upland and riparian vegetation would

reduce the amount of available habitat for amphibians, reptiles, birds, and mammals. Revegetation of an estimated 490 acres of pit walls and mine rock area slopes would not be feasible. Reclamation of other areas may restore vegetative cover of chaparral, grassland, and riparian habitats.

Riparian vegetation in lower Haunted Canyon and Pinto Creek could be indirectly affected by water quality changes, flow alterations, and temporary increased sedimentation.

Changes in water quality, flow regimes, and riparian vegetation could also affect amphibians, birds, and mammals that are dependent on surface water and/or riparian habitat in Haunted Canyon, Powers Gulch, and Pinto Creek. There is the potential that pumping from the water supply wells and pit dewatering could reduce riparian vegetation and aquatic habitat for amphibians. Mitigation and monitoring measures, as well as BMPs to be implemented for the Carlota Copper Project (see Sections 3.3.4 and 3.3.5), are designed to protect streamflows and water quality in project area drainages and would minimize short- and long-term impacts to riparian and aquatic habitats.

A total of 9.12 acres of waters of the U.S. would be lost because of the Pinto Creek diversion around the Carlota/Cactus pit and the Main mine rock disposal area and the Powers Gulch diversion around the heap-leach pad. An additional 0.34 acre of jurisdictional wetlands would be impacted in the Pinto Creek drainage.

The proposed action would disturb approximately 23.9 acres of occupied habitat and 237.6 acres of potential habitat for the Arizona hedgehog cactus. Indirect impacts on additional cactus plants may occur because of activities near the pits, access roads, leach pad, and Powers Gulch diversion. Mitigation measures consisting of transplanting, avoidance, and reclamation would reduce the number of individual cacti affected to approximately 10 to 20 percent of the population within the project area. Mitigation measures to be implemented for the project should compensate for these losses. The U.S. Fish and Wildlife Service (1996) has concurred with this conclusion with its issuance of a "non-jeopardy" opinion in its Biological Opinion on the effects of the Carlota Copper Project. For details regarding specific mitigation measures, please see Section 3.5.4.

There would be no adverse effects on any federally listed threatened or endangered wildlife species. Potential effects to other wildlife species of concern include loss of riparian habitat for the common black-hawk and yellow-billed cuckoo, reduction in suitable breeding habitat for the Arizona toad and lowland leopard frog, and loss of open chaparral and dry-slope desert brush habitats for loggerhead shrike. Mitigation and monitoring measures, as well as BMPs to be implemented for the Carlota Copper Project, would minimize short- and long-term impacts to downstream areas of riparian and aquatic habitat for common black-hawk, yellow-billed cuckoo, Arizona toad, and lowland leopard frog. There would be a minor reduction in suitable breeding habitat for the Arizona toad and lowland leopard frog along Pinto Creek within the project area, but project development is not likely to adversely affect populations of these species in Haunted Canyon or in the downstream portions of Pinto Creek. For loggerhead shrike, approximately 488 and 118 acres of dry-slope desert brush and juniper/grassland, respectively, would be lost or disturbed with project implementation. Within the Pinto Creek drainage basin, this would result in a relatively minor reduction of suitable habitat. Suitable habitat is not limited in this region; therefore, minor reductions in habitat might affect a few individual birds but would not adversely affect regional populations of loggerhead shrike. These impacts are described in greater detail in Section 3.5.2.

Aquatic Biology

Stream diversions would result in the loss of aquatic habitat in Pinto Creek (1.24 acres) and Powers Gulch (0.84 acre), which would affect aquatic macroinvertebrates and fish populations in Pinto Creek and invertebrate populations in Powers Gulch. Aquatic communities would recolonize the new stream diversion segments within several years.

Reduction of streamflows associated with the water supply wells and pit dewatering could decrease the amount of habitat for aquatic organisms in Haunted Canyon, Powers Gulch, and Pinto Creek, including populations of desert sucker and longfin dace in Haunted Canyon and Pinto Creek. The mitigation measures for returning surface flows to these streams may minimize the level of impacts.

Adverse water quality effects could result from construction and operation activities. Construction would cause temporary increases in sedimentation, which could result in reduced numbers of macroinvertebrates and fish in localized areas receiving sediment.

Facility operations could result in toxicity and/or acidity to aquatic organisms and their environment should discharges (leaks or spills) from the leach pad or mining solutions occur. Other designated uses could be affected similarly. Mitigation and monitoring measures provided in Section 3.5.4, as well as BMPs to be implemented for the Carlota Copper Project, would minimize the risk of accidental spills.

Existing populations of the desert sucker, Maricopa tiger beetle, Arizona toad, lowland leopard frog, and longfin dace in Haunted Canyon, Powers Gulch, and Pinto Creek could be adversely affected by sedimentation (temporary and localized), well field development and pit dewatering, and spills or leaks from the leach pad (see Section 3.5.2).

Cultural Resources

Construction and mining activities would impact a settlement area containing 89 historic, prehistoric, and traditional cultural properties sites. Of these, 56 sites would be directly affected and 12 would be indirectly affected by project activities. Of the 56 sites located in direct impact areas, 35 meet the eligibility criteria for the National Register of Historic Places (NRHP); 8 of the 12 indirectly affected sites meet these criteria. While analysis of the alternatives assesses direct and indirect impacts, the discussion of mitigation measures provided in Section 3.6.4 focuses on the impacts to the overall settlement area.

Socioeconomics

Temporary socioeconomic impacts from the proposed action would occur during construction and operation, primarily in nearby communities. There would be slight increases in population growth ranging from less than 1 to approximately 3.6 percent in the nearby communities. Substantial increases in employment would occur during construction (temporary use of

177 workers) and operation (permanent use of 255 to 301 workers).

Influxes of construction and operation workforces would have both adverse and beneficial impacts. An increased demand for housing, retail facilities, and community services would result from the workforce. Except for law enforcement requirements by the Gila County Sheriff's Department and the municipal water supply in Miami, existing public services would be adequate for the increased growth. Benefits to local communities would include increased retail sales and employment. No major adverse impacts would occur in lifestyles, social organizations, attitudes, beliefs, or values because of the project.

Financial impacts of the proposed action would include the payment of severance and corporate income taxes to the State of Arizona and annual property taxes to Gila and Pinal counties. Wages spent by workers would continue to contribute to local revenues through sales and use taxes.

Project operation would result in an economic impact to two grazing permittees. This impact would be reduced after closure and reclamation. Pit dewatering may also affect water availability in wells used by the Top-of-the-World community.

These impacts, as well as related mitigation measures, are described in Sections 3.7.2 and 3.7.4, respectively.

Land Use

The proposed action would be consistent with the *Tonto National Forest Plan*. In addition, there would be no change in land status or ownership. However, the proposed project would limit public access for fuel wood salvage. The existing permit to the Salt River Project would be amended to include an electrical transmission right-of-way and power line. Land use changes would include an increase in mining activity, a reduction in grazing on approximately 1,500 acres and grazing permit modifications, and a reduction in recreational activities (i.e., elimination of horseback riding and hiking along Powers Gulch to access Forest Service Trail 203). See Section 3.8.2 for a detailed description of the impacts to this resource.

Recreation

The proposed action would result in no adverse effects on dispersed recreational activities or facilities, except for horseback riding and hiking access to Haunted Canyon and the Superstition Wilderness via Powers Gulch. The slight population growth would cause minor increases in recreation visitor days and use of local community recreational facilities. The Recreation Opportunity Spectrum would be changed from "Roaded Natural Area" to "Urban." Adverse impacts, as described in Section 3.9.2, would occur for recreational activities or experiences (e.g., hunting, hiking, birdwatching, etc.) because of increased use, land disturbance, aesthetic impacts, or increased noise levels. Access to Forest Service Trail 203 would be limited because of project activities in Powers Gulch. The project would result in a temporary loss of recreational use within most of the project area; recreational use in the area of the pits and possibly the leach pad would be permanently lost.

Wilderness and Wild and Scenic Rivers

Access to the Superstition Wilderness via Forest Service Trail 203 would be reduced. Noticeable adverse noise impacts would occur at the eastern edge of the Superstition Wilderness. Minor effects would be expected on the Sierra Ancha Wilderness from increased visitor use associated with an increased population.

It is anticipated that the segment of Pinto Creek being considered for Wild or Scenic designation would not be significantly affected by ground water withdrawal from the well field, since the relevant segment of Pinto Creek is located below the Pinto Valley weir approximately 5 miles north and downstream of the confluence of Pinto Creek and Haunted Canyon and below the drainages of Horrel Creek and West Pinto Creek. Well field pumping and pit dewatering could result in a small potential reduction in surface water flow along the 8.8-mile segment of Pinto Creek being considered for Wild or Scenic designation; at this time, the potential impact cannot be quantified.

Water quality would also be a factor influencing the potential Wild or Scenic designation of the stream. If current water quality conditions change, Pinto Creek could become ineligible for Wild or Scenic designation.

It is anticipated that water quality within the 8.8-mile segment of Pinto Creek would not be adversely affected by mine operations; however, a catastrophic event could affect water quality along this portion of the creek. See Sections 3.10.2 and 3.3.2 for more information on water quality in this segment of Pinto Creek.

Visual Resources

Visual effects of the proposed action would include moderate, short-term impacts from U.S Highway 60; low, short-term impacts from the Superstition Wilderness viewpoint; and moderate to high, short-term impacts from the Top-of-the-World viewpoint (i.e., ridge north of the subdivision). Impacts would comply with the Visual Quality Objectives at all viewpoints except Top-of-the-World. Minor visual effects would result from light spill and glare during nighttime operation from all viewpoints. See Section 3.11.2 for more details.

Noise

Project-generated noise would exceed ambient background levels along a portion of the eastern boundary of the Superstition Wilderness throughout the duration of the project. Project-generated noise at the Top-of-the-World community would be minor throughout the duration of the project, resulting in levels that would be lower than the Housing and Urban Development acceptable noise standard for residential areas. Noise impacts and associated mitigation are discussed in Sections 3.12.2 and 3.12.4, respectively.

Transportation

Two major categories of traffic would be generated by the proposed action: worker commuting traffic and material deliveries. Approximately 107 vehicles would be added to the traffic flow on U. S. Highway 60 during peak hours. Traffic flows would remain at level of service C for both segments of the major arterial. No transportation safety concerns would exist because of the recent reconstruction of the Pinto Valley Mine Road intersection. Commercial traffic may benefit from the increased population base and increased business activity. Closure of Forest Service Road 898 would conflict with the Resource Access Travel Management Plan; however, portions of the

road are currently impassable, and the Plan conflict is not considered significant.

There may be transportation impacts associated with the use of Forest System Trail 203 for recreation and well field access (see Section 3.13.2 for more details).

Hazardous Materials

The proposed action may result in potential impacts to environmental resources caused by an accidental release of hazardous materials transported to, stored, and used at the site. Section 3.14.2 describes these potential impacts.

Alternatives

Alternatives being considered for the proposed Carlota Copper Project involve differences in various project components. Most impacts from the alternatives on environmental resources would be similar to the relevant component of the proposed action. Therefore, impact summaries for the alternatives only list those impacts that differ from the proposed action. The environmental consequences of each alternative are detailed in the respective Environmental Consequences sections of Chapter 3.

Mine Rock Disposal Alternatives

Alternative Mine Rock Disposal Sites

Air Resources. There would be a slight increase in air emissions associated with the alternative mine rock disposal sites.

Geology and Minerals. The total area of disturbance would increase by approximately 44 acres with the Cactus South and Cactus Central mine rock disposal areas. Mineral resources would not be affected because no known deposits exist within these alternative sites.

Water Resources. For the proposed Cactus South alternative mine rock disposal area, the potential exists for relatively low-quality surface water, already present in Cottonwood Gulch, to seasonally move through and discharge from the rock disposal facility. It is likely that the discharge from the mine rock would

violate water quality standards. After closure, poor water quality may result from ponding behind the Cactus South location.

Soils and Reclamation. An additional 44 acres of native soils would be disturbed by using the Cactus Central and Cactus South mine rock disposal areas. Reclamation could be completed on approximately 27 of these additional acres.

Terrestrial Biology. An additional 44 acres of upland vegetation would be disturbed by the Cactus Central and Cactus South mine rock disposal areas. Slight adverse effects would occur for loggerhead shrike with the loss of this acreage. Sedimentation and potential water quality impacts would be greater than with the proposed action.

Aquatic Biology. Increased impacts to longfin dace and desert sucker from additional sedimentation would occur with this alternative.

Cultural Resources. Disturbance associated with the Cactus Central and Cactus South areas would impact four additional cultural sites (two direct and two indirect).

Land Use. Land use change would occur on 22 acres in the Tonto National Forest and 22 acres of private land.

Noise. Project-related noise levels would be approximately the same or less than the proposed action since the mine rock disposal areas would be located farther from the Superstition Wilderness and Top-of-the-World. Noise levels would exceed background levels at the Superstition Wilderness boundary, but they would be within acceptable levels at Top-of-the-World.

Additional Backfill of the Carlota/Cactus Pit

Air Resources. Emissions associated with the actual pit backfilling would continue for an additional 3 to 4 years. There would be a slight decrease in long-term air emissions with the additional backfilling of the Carlota/Cactus pit because of an increase in the area reclaimed.

Geology and Minerals. An estimated 14 million tons of potential mineral resource may be rendered uneco-

nomical to recover in the future because of the additional backfilling of the Carlota/Cactus pit. The long-term stability of the pit walls would increase, and the potential for slope failure of the Carlota/Cactus pit wall would be eliminated.

Water Resources. Additional backfill would prevent a pit lake from forming; pit water quality and evaporative losses would not be a concern. In addition, 0.5 square mile of contributing watershed would be restored.

Soils and Reclamation. Additional backfilling of the Carlota/Cactus pit would provide an additional 153 acres of reclaimable area. The erosion potential of the Main mine rock area would be reduced. This alternative would result in a substantial increase in reclamation costs.

Terrestrial Biology. The additional backfilling of the Carlota/Cactus pit would result in slight reductions in long-term impacts to vegetation. Approximately 153 additional acres of disturbance associated with the Carlota/Cactus pit and the Main mine rock area would be reclaimed. Replacing upland vegetation would result in no long-term impacts to loggerhead shrike.

Cultural Resources. With the additional backfilling of the Carlota/Cactus pit, construction and mining activities would affect the same number of cultural sites as the proposed action.

Socioeconomics. A workforce of 190 for an additional 3 to 4 years to backfill the Carlota/Cactus pit would extend the impacts associated with population growth, employment, housing demands, public service demands, and financial benefits. Mining costs would increase because of additional backfilling.

Land Use. Additional backfilling would increase the reclaimed area by approximately 153 acres.

Noise. Project-related noise levels would be slightly increased because of the additional material handling and transporting associated with the additional backfilling of the Carlota/Cactus pit.

Additional Backfill of the Eder South Pit

Air Resources. There would be a slight decrease in long-term air emissions with the additional backfilling of the Eder South pit because of an increase in the area reclaimed.

Geology and Minerals. The long-term stability of the pit walls would increase with the additional backfilling of the Eder South pit.

Water Resources. Additional backfill would be accomplished with material from the Eder mine rock area. This would improve slope stability within the mine rock area and would reduce the potential for mine rock to migrate or slide downslope, thereby compromising the integrity of the Powers Gulch diversion in terms of water conveyance and sediment transport.

Soils and Reclamation. An additional 16 acres of reclaimable area within the pit and 33 acres at the disposal site would be available with this alternative. There would be less potential erosion because of the elimination of the Eder mine rock area. There would be a substantial increase in reclamation costs.

Terrestrial Biology. Effects on vegetation and associated wildlife species would be reduced with the additional backfilling of the Eder South pit. Excavation and construction of the Eder pits and mine rock disposal area would disturb approximately 140 acres of upland habitat. The additional backfilling of the Eder South pit and reclamation of the Eder mine rock disposal area would allow the reclamation of approximately 49 additional acres of the disturbance. Additional habitat for the Arizona hedgehog cactus may be created in the pit backfill to partially offset the habitat loss associated with the pit excavation. Replacement of upland vegetation would result in no long-term impacts on loggerhead shrike.

Cultural Resources. The additional backfilling of the Eder South pit would indirectly affect one cultural site, which is the same as the Eder South pit in the proposed action.

Socioeconomics. A workforce of 190 for an additional 2.3 months would extend the impacts associated with population growth, employment, housing demands, public service demands, and annual revenues. Mining costs would increase with this alternative.

Land Use. Additional backfilling would increase the reclaimed area at the Eder mine rock disposal area by 33 acres. The additional reclaimed area would include 16 acres for the Eder South pit.

Visual Resources. Removal of the mine rock disposal area would reduce the visible extent of the disturbed areas, and the view of the background would be opened.

Noise. Project-related noise would be slightly increased with the additional backfilling of the Eder South pit because activity would be closer to the Top-of-the-World community; however, levels at the community would be within the acceptable standard. Impacts on the Superstition Wilderness would be generally similar to the proposed action.

Eder Side-Hill Leach Pad Alternative

Air Resources. There would be a slight increase in fugitive dust emissions with the Eder side-hill leach pad. Other air emissions would be similar to the proposed action.

Geology and Minerals. The greater potential for instability associated with a side-slope configuration represents an increased risk associated with slope failure impacting the heap.

Water Resources. The need for the Powers Gulch diversion would be eliminated. However, approximately 1,000 feet of Powers Gulch could require realignment. Erosion and sediment yield would increase during postclosure because of increased acreage and slopes. The steep side-slope configuration could increase the potential for heap slope failure into Powers Gulch and for a heap-leach solution release that could adversely affect water resources. The potential risk to the heap from failure of the Powers Gulch diversion would be eliminated. Seasonally high ground water conditions would not be a potential problem for this alternative. There would

be a temporary withdrawal of 0.9 square mile of contributing watershed area.

Soils and Reclamation. Additional disturbance would affect approximately 134 acres of soils. Of this amount, approximately 34 acres would be removed from postmining land uses. The disturbance to alluvial soils would be reduced (12 acres); this area could potentially support riparian vegetation. The amount of topsoil available for reclamation would be reduced.

Terrestrial Biology. The estimated loss of vegetation and associated wildlife species would include 495 acres of upland habitat compared to approximately 386 acres for the proposed action. This alternative would increase the potential for accidental releases of leach solution into Powers Gulch. Potential impacts on amphibians and other wildlife species using the streams would be reduced by placing the pads outside of the drainage. There would be a potential loss of approximately 20 acres of occupied Arizona hedgehog cactus habitat.

Aquatic Biology. Placing the pads outside the Powers Gulch drainage would increase the potential impacts of sedimentation and accidental spills or leaks on aquatic communities because of greater instability associated with this alternative. Placing the pads outside the Powers Gulch drainage also would increase sedimentation and potential effects from accidental spills or leaks on existing desert sucker, Maricopa tiger beetle, Arizona toad, lowland leopard frog, and longfin dace populations and potential Gila topminnow habitat.

Cultural Resources. This alternative would impact 35 cultural sites (19 direct and 16 indirect), which would be the same as the proposed action.

Socioeconomics. Property values at the Top-of-the-World area may be adversely affected by increased noise and visual impacts.

Land Use. Approximately 134 acres of additional disturbance would occur near Powers Gulch as a result of the Eder side-hill leach pad and Eder mine rock area.

Recreation. Dispersed recreational activities would decrease in the additional area of disturbance near Powers Gulch.

Wilderness and Wild and Scenic Rivers. There would be a greater risk of catastrophic impacts to downstream water quality.

Visual Resources. There would be no visual impacts from the U.S. Highway 60 key observation point (KOP), and there would be minor visual impacts from the Superstition Wilderness KOP. Relatively high, long-term visual impacts would result for the Top-of-the-World viewpoint.

Water Supply Alternative

Geology and Minerals. Several miles of a low-quality water pipeline would be added with associated risks to the pipeline from landslides and slope instability.

Water Resources. The pipeline could be damaged during the life of the project; water released if the pipeline failed could potentially pollute ground and surface water. The use of low-quality water would reduce the need for ground water pumping and would result in a substantial reduction in water withdrawal from the Pinto Creek drainage.

Terrestrial Biology. There would be reduced effects of dewatering on riparian vegetation and associated wildlife and amphibian species since less water would be pumped from the wells. Potential water quality effects are described in the previous section.

Aquatic Biology. Reduced pumping requirements from the well field would lessen the dewatering impacts on aquatic habitats in Haunted Canyon and Pinto Creek, including threatened and endangered fish habitat. Potential sedimentation and poor water quality could affect aquatic communities because of pipeline construction and accidental spills or leaks of the low-quality water.

Cultural Resources. No sites would be affected by the low-quality water alternative.

Socioeconomics. The acquisition of low-quality water and construction of a pipeline would increase Carlota's production costs. The pipeline would also increase assessed valuation and thus property value revenues in the region.

Land Use. Construction of the water pipeline, pumping stations, access roads, and power lines would result in additional land use changes.

Wilderness and Wild and Scenic Rivers. A decrease in ground water pumping would result in a slightly decreased potential for effects on the scenic and ecological values of the Pinto Creek segment potentially eligible for Scenic status. However, a spill of low-quality water from the pipeline may cause short-term effects on the ecological values.

Visual Resources. There would be minor visual impacts associated with pipeline construction and operation from all viewpoints.

Noise. Minor additional noise impacts would occur during construction; impact conclusions would be the same as with the proposed action.

Water Supply Well Field Access Road Alternatives

Access Road Alternatives A and B

Geology and Minerals. There would be a low risk of induced slope failure associated with Alternatives A and B. There would be a moderate to high potential for increased sedimentation in Pinto Creek for Alternative A until BMPs are implemented, and a moderate potential for Alternative B.

Terrestrial Biology. Alternative A would improve an existing road along the Pinto Creek riparian corridor. Aside from the loss of 4 acres of previously disturbed riparian vegetation, project-related use of this road would result in a minor incremental increase in human disturbance impacts to wildlife species along this portion of the riparian corridor. Alternative B would impact fewer acres of the more abundant upland habitats; it would not disturb riparian vegetation.

Aquatic Biology. Higher, long-term sedimentation impacts would occur to longfin dace and desert sucker habitat with Alternative A because of the increased maintenance requirements. Alternative B would result in moderate, adverse direct and indirect impacts to these species.

Cultural Resources. One site would be directly affected, representing an increase of one site compared to the proposed action.

Recreation. Access would be improved for recreational activities (hiking, four-wheel driving, horseback riding). Additional noise and visual impacts from four-wheel drive vehicle use would represent potential adverse impacts for some recreational groups.

Visual Resources. There would be reduced visual impacts from all viewpoints since Alternative A would follow an existing road in the bottom of the drainage. Except for a small portion near the confluence of Haunted Canyon and Powers Gulch, Alternative B would not be visible from any commonly used viewpoints.

Transportation. Alternative A would affect a longer segment of Forest Service Trail 203.

No Action Alternative

Under this alternative, the construction and operation of the Carlota Copper Project and the associated recovery of the copper ore would not occur. The existing conditions in the project area would be maintained. Mineral resources would still be available for future development.

Agency Preferred Alternative

The Forest Service has selected Carlota's proposed action as the agency preferred alternative with the following modifications:

- Inclusion of the alternative to place additional backfill into the Eder South pit
- Inclusion of the water supply alternative to combine low-quality water, water supply wells, and dewatering wells
- Inclusion of the access road alternative A in place of the proposed action to provide secondary access from the north to the well field

After Carlota's submission of its initial Plan of Operations, the Forest Service, other agencies, and the public scoping process identified a wide range of

project alternatives (component alternatives) that potentially offered less impact on the resources in the area. A number of these alternatives, such as partial backfilling of the Carlota/Cactus pit, access from the Pinto Valley Mine road, and incorporation of the pregnant leach solution (PLS) ponds within the leach pad were subsequently incorporated into the proposed action.

Following the public comment period for the Draft EIS, additional changes were made to further address important issues. Potential alternatives that had been eliminated from detailed consideration were redefined and reassessed with regard to technical, legal, and economic feasibility. An inlet control structure to regulate flows into the Powers Gulch diversion was incorporated into the leach pad design. Another potential source for low-quality water, BHP Copper's Cottonwood storage pond, was identified. New design technology with higher standards for heap-leach solution containment and water conservation measures were incorporated into the proposed action. Also, monitoring and mitigation measures were more fully developed.

The agency preferred alternative would provide a higher level of environmental protection than the proposed action. The impacts of the agency preferred alternative are listed in the impact comparison tables (*Tables 2.16-a through 2.16-p*).

The key impact differences between the proposed action and the agency preferred alternative relate to an increase in the area to be reclaimed, a reduction in the potential for localized sedimentation, a potential decrease in the use of local aquifers, and elimination of a new access road outside of the immediate project area.

The key impact differences associated with the additional backfill of the Eder South pit are described below:

- Air Quality - Slight decreases in long-term air emissions
- Geology and Minerals - Increased long-term stability of the Eder South pit wall, Eder slope, and Powers Gulch area; reduced threat to Powers Gulch diversion system and heap-leach pad

- Water Resources - Reduced long-term risks of sediment transport and potential impacts to Powers Gulch diversion because of the elimination of the Eder mine rock area at closure
- Soils and Reclamation - Additional reclaimed areas within the pit and at the disposal site; increased costs; reduced potential for erosion because of the elimination of the Eder mine rock disposal area
- Terrestrial Biology - Additional reclaimed areas for upland vegetation and associated wildlife; increased potential area for reclaiming upland habitat, especially for sensitive species, such as loggerhead shrike
- Socioeconomics - Beneficial and adverse impacts of workforce for additional 2.3 months
- Land Use - Additional reclaimed areas associated with the additional backfill of the Eder South pit and Eder mine rock area available for postmining uses
- Visual Resources - Reduced visible extent of disturbed areas and a more open view of the background
- Noise - Slight, temporary increased noise levels

The key impact differences associated with using low-quality water in addition to water supply wells and dewatering wells are described below:

- Geology and Minerals - Addition of several miles of low-quality water pipeline and associated risks to the pipeline from landslides and slope instability

- Water Resources - Potential reduction of impacts to Haunted Canyon and Pinto Creek associated with water supply well field pumping (if the pipeline is damaged during the life of the project, water released could potentially affect ground and/or surface water quality)
- Land Use - Potential for an additional pipeline right-of-way on National Forest System lands
- Aquatic Biology - Less potential for reducing surface water flow; therefore, reduced impacts to aquatic biota

The key impact differences associated with using the Alternative A access road to the well field include the following:

- Geology and Minerals - Reduced soil disturbance and erosion in a portion of Pinto Creek; reduced risk of induced slope instability
- Water Resources - Located in the Pinto Creek floodplain; more efficient access to water monitoring sites
- Soils and Reclamation - Slight decrease in soil disturbance; no new road construction
- Terrestrial Biology - Continued disturbance of riparian vegetation during project operation
- Land Use - Reduced land use disturbance in the Pinto Creek area
- Recreation - Slight reductions in noise and visual impacts on hiking and horseback riding

1.0 INTRODUCTION AND PURPOSE AND NEED

1.0 Introduction and Purpose and Need

1.1 Introduction

The Carlota Copper Company (Carlota) has submitted a Plan of Operations and a subsequent Update to the Plan of Operations to the Tonto National Forest for the construction, operation, and reclamation of the Carlota Copper Project, a copper mining and processing operation. The proposed project is located on lands administered by the Globe Ranger District of the Tonto National Forest. In accordance with 40 *Code of Federal Regulations* (CFR) 1501.4, the Forest Service has reviewed the proposal and determined that preparation of an environmental impact statement (EIS) is necessary. The Forest Service is serving as the lead agency for preparing this EIS in accordance with the National Environmental Policy Act (NEPA) of 1969; the Arizona Department of Environmental Quality (ADEQ) and the U.S. Army Corps of Engineers (COE) are cooperating agencies. Other agencies participating in the development of the EIS include:

- U. S. Environmental Protection Agency, (EPA) Region IX - air quality, water quality, and hazardous materials
- U. S. Fish and Wildlife Service - vegetation, wildlife, and threatened and endangered species
- Arizona Game and Fish Department - wildlife and state-listed threatened wildlife species

This EIS has been prepared in compliance with NEPA; the Council on Environmental Quality (CEQ) regulations for Implementation of Procedural Provisions of NEPA (40 CFR 1500-1508); the *Forest Service Environmental Policy and Procedures Handbook* (Forest Service Handbook, 1909.15); the COE Procedures for Implementing NEPA (30 CFR 230 and 325); and the EPA Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230). The EIS describes the proposed Carlota Copper Project, the project alternatives, and the environmental consequences of implementing the proposed action or the project alternatives, including the no action alternative.

1.2 Project Location

The Carlota Copper Project is located in Gila and Pinal Counties, approximately 6 miles west of Miami,

Arizona, in the Globe-Miami Mining District (*Figure 1-1*). The project is located north of U.S. Highway 60, approximately 1 mile north-northeast of the community of Top-of-the-World, and immediately southwest of BHP Copper Inc.'s (formerly Magma Copper Company's) Pinto Valley Mine. The project area contains approximately 3,050 acres; the proposed action would disturb approximately 1,428 acres of private and National Forest system lands.

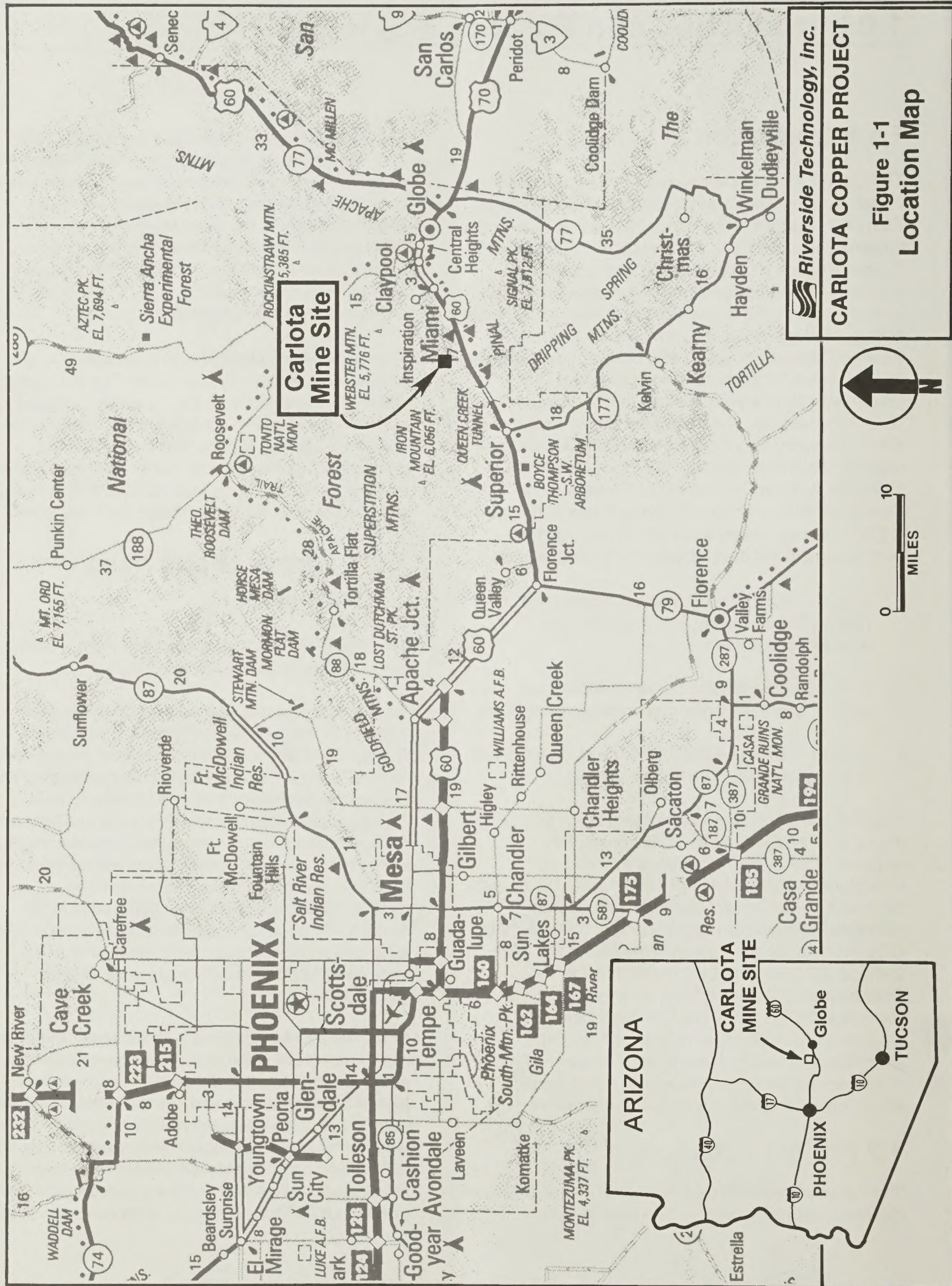
The Globe-Miami Mining District has a history of mineral exploration and production. The proposed action would extract all of the mineable reserves that are currently known to exist in the immediate project area. Reclamation of disturbed areas, where practicable, would allow the Forest Service to continue to manage surface resources consistent with the goals and objectives of the *Tonto National Forest Plan*.

1.3 Purpose of and Need for Action

The purpose(s) and the need(s) are used to define the range of alternatives analyzed in the EIS.

From the perspective of the Forest Service, the purpose of the proposed action is for the Carlota Copper Company to mine and process copper ore and for the Forest Service to meet its responsibilities to manage surface resources consistent with laws including, but not limited to, the Mining and Mineral Policy Act of 1970, the Federal Management Policy Act of 1976, and the administrative requirements of 36 CFR 228, Subpart A. From the perspective of the COE, in its consideration of an application for a Section 404 permit, the overall project purpose is to mine and process copper in Arizona using a hydrometallurgical process to produce copper cathodes.

From the broad or macro-economic scale, the project need is reflected in the overall scarcity of copper world-wide to meet the demand. The world-wide demand for copper currently exceeds the available supply. For the 5-year period ending in 1988, the free world consumption of copper exceeded the output by 1.75 million tons. The United States "net import reliance as a percent of apparent consumption" was 9 percent, or 203 thousand tons of refined copper, as



reported in the U.S. Bureau of Mines Commodity Summaries - 1990 (Peterson 1994). The United States is a net importer of copper. The production from the Carlota Copper Project should help reduce the United States' dependency on foreign copper.

The need, from the perspective of the Forest Service, is described below:

- Respond to Carlota's assertion of its mineral rights to the Carlota, Cactus, and Eder orebodies
- Ensure the proposed action, and any alternative, will comply with other applicable federal and state laws and regulations
- Ensure the proposed action, where feasible, minimizes adverse environmental impacts on National Forest surface resources
- Ensure measures are included, where practicable, that provide for reclamation of the surface disturbance

In accordance with the Clean Water Act (CWA) Section 404(b)(1) guidelines of 40 CFR 230, the COE may only permit the least environmentally damaging, most practicable alternative in light of cost, logistics, and technical considerations and must consider the applicable need(s) when defining the project purpose.

The proposed Carlota copper mine will require a permit under purview of Section 404 of the Clean Water Act to discharge fill material into Pinto Creek and Powers Gulch prior to disturbing waters of the U.S. The COE scope of review for impacts to jurisdictional waters will be based upon the impact assessment in this EIS and the COE's public interest review. In addition to the alternatives evaluated in Chapter 3 of this EIS, an alternatives analysis that addresses CWA Section 404(b)(1) guidelines is included in Appendix A, Section 404 Permit Alternatives Analysis.

1.4 Authorizing Actions

The decision to be made regarding the Carlota Copper Project is the selection of either the proposed action or an alternative (including the no action alternative) for

implementation and the stipulation of measures to mitigate adverse environmental impacts. Descriptions of the proposed action and the project alternatives are provided in Chapter 2, Alternatives Including the Proposed Action. The Tonto National Forest Supervisor is the responsible official for a decision relative to the EIS.

The decision to issue, issue with special conditions, or deny a CWA Section 404 Permit will be made by the District Engineer, Los Angeles District, COE for the discharge of dredged or fill material to divert Powers Gulch and Pinto Creek.

In addition to the EIS, implementing the proposed Carlota Copper Project or the alternatives would require authorizing actions from the Forest Service and other federal, state, and local agencies with jurisdiction over the project. The authorizing actions include environmental permits, licenses, or approvals required for project construction or operation. *Table 1-1* summarizes the principal authorizing actions required for the Carlota Copper Project.

1.5 Issues

The environmental issues raised during the public scoping process and agency coordination for the Carlota Copper Project are identified in Chapter 3 of this EIS by the environmental resource to which they pertain.

1.6 Interrelated Actions

1.6.1 Introduction

As defined in the CEQ regulations for implementing NEPA (40 CFR 1508.7), "*Cumulative impact* is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." In determining the scope of an EIS, cumulative impacts must be addressed as one of the types of actions and impacts that are evaluated (40 CFR 1508.25).

Table 1-1. Environmental Regulatory Requirements for the Carlota Copper Project

Authorizing Agency	Law or Regulation	Permit or Approval
Forest Service	<ul style="list-style-type: none"> • 1872 Mining Law (36 CFR 228) • NEPA • National Historic Preservation Act of 1966 as amended (NHPA) • Antiquities Act of 1906 • Archaeologic Resources Preservation Act (ARPA) of 1979 • Executive Order 11987 • Executive Order 11988 • Executive Order 11990 • Executive Order 12898 • National Forest Management Act • Endangered Species Act • Clean Air Act • Migratory Bird Treaty Act 	<ul style="list-style-type: none"> • Plan of Operations • EIS; Special Use Permits • Cultural Resources Mitigation • Cultural Resources Mitigation • Cultural Resources Mitigation • Exotic Organisms • Floodplain Management • Protection of Wetlands • Environmental Justice • Maintenance of Viable Species Populations • Biological Assessment/ Section 7 Consultation with U.S. Fish and Wildlife Service • Conformity with SIP/Protection of Visibility Class I Areas • Protection of Migratory Birds
U.S. Fish and Wildlife Service	<ul style="list-style-type: none"> • Endangered Species Act • Fish and Wildlife Coordination Act 	<ul style="list-style-type: none"> • Section 7 Consultation (Biological Opinion) • Consultation on CWA 404 Permit
U.S. Environmental Protection Agency	<ul style="list-style-type: none"> • CWA • Clean Air Act 	<ul style="list-style-type: none"> • National Pollutant Discharge Elimination System (NPDES) Stormwater and Point Source Discharge Permits • Delegated to ADEQ
U.S. Army COE	<ul style="list-style-type: none"> • CWA 	<ul style="list-style-type: none"> • Section 404 Permit

Table 1-1. Environmental Regulatory Requirements for the Carlota Copper Project (continued)

Authorizing Agency	Law or Regulation	Permit or Approval
Arizona Department of Environmental Quality	<ul style="list-style-type: none"> • Arizona Revised Statutes • CWA • Arizona Revised Statutes • Hayden Area State Implementation Plan (SIP) • Arizona Ambient Air Quality Guidelines • Arizona Administrative Code 	<ul style="list-style-type: none"> • Aquifer Protection Permit/Spill Prevention and Countermeasure Control • State 401 Certification • Air Quality Permits to Install and Operate • Conformity with SIP • Toxic Air Pollutant Standards • Water Quality Standards
Arizona Department of Water Resources	<ul style="list-style-type: none"> • Arizona Revised Statutes 	<ul style="list-style-type: none"> • Well Registration, Surface Water Rights, Dam Safety Permit
Arizona Game and Fish Department	<ul style="list-style-type: none"> • Arizona Revised Statutes - Title 17 • Fish and Wildlife Coordination Act 	<ul style="list-style-type: none"> • Authority over State Wildlife • Coordination with U.S. Fish and Wildlife Service; Consultation with U.S. Fish and Wildlife Service on CWA 404 Permits
All State Agencies	<ul style="list-style-type: none"> • State Executive Order 89-16 • State Executive Order 91-6 	<ul style="list-style-type: none"> • Streams and Riparian Resources • Protection of Riparian Areas
Arizona State Historic Preservation Office	<ul style="list-style-type: none"> • NHPA 	<ul style="list-style-type: none"> • Cultural Resources Consultation
Arizona Department of Agriculture	<ul style="list-style-type: none"> • Native Plant Law 	<ul style="list-style-type: none"> • Plant Removal Permit
Arizona State Mine Inspector	<ul style="list-style-type: none"> • Arizona Mined Land Reclamation Act 	<ul style="list-style-type: none"> • Reclamation Plan Approval; Financial Assurance
Gila and Pinal Counties	<ul style="list-style-type: none"> • County Ordinances 	<ul style="list-style-type: none"> • Sewer System Approval, Zoning Ordinances, Building Permits • Pinal County Air Quality Standards

The Forest Service has identified “past, present, and reasonably foreseeable future actions” with the potential to result in cumulative impacts with the Carlota Copper Project. These actions were identified based on type of activity, geographic location, and time period to determine the potential for cumulative impacts to individual resources. Interrelated actions are defined as those that are not connected to the proposed action but have caused, or will cause, similar impacts to the affected environment. The interrelated actions that were considered in the cumulative impact analysis were divided into the following categories: mining, grazing, energy and transmission, water resources, transportation, and private land development. A brief description of past, present, and proposed future actions for each of these categories is provided below.

The study area boundary for the cumulative impact analyses varies depending on the resource being evaluated. The cumulative impact study area was determined for each resource based on the issues and concerns developed during the scoping process and the potential impacts of the interrelated actions. When considering resources such as socioeconomics and the interrelated actions, a regional study area was defined in general terms as follows: Roosevelt Lake (north), San Carlos (east), Coolidge Dam (southeast), Apache Junction (west), and Florence (southwest) (*Figure 1-2*). The study area for the other resources encompassed a smaller area, which was generally defined as Roosevelt Lake to the north, Globe to the east, and Superior to the southwest (*Figure 1-2*). The resources potentially affected by the various types of interrelated actions are identified in *Table 1-2*. The cumulative impact study area and the potential cumulative impacts for each resource are described in the respective cumulative impact sections of Chapter 3, Affected Environment and Environmental Consequences.

1.6.2 Past, Present, and Reasonably Foreseeable Future Actions

1.6.2.1 Mining Projects

Mining and grazing are the dominant activities occurring in the cumulative impact study area. The locations of potentially interrelated mining projects are shown in *Figure 1-2* (M-1 through M-10). Stereo-

paired aerial photographs (U.S. Geological Survey [USGS] 1992) were interpreted to delineate areas affected by past mining activity within the Globe-Miami-Superior mineral belt. The identified areas were plotted on 7.5-minute USGS quadrangle maps and planimetered to determine the affected acreages. The locations of the disturbed mining areas and the corresponding estimated acreages of disturbed land are presented in *Figure 1-3*. Mining disturbance has included exploration (drilling, trenching, sampling, and road construction), open-pit and underground mining, waste rock disposal, heap leaching, ore milling and processing, and tailings disposal. Past mining projects in the study area include BHP Copper Inc.'s (BHP Copper's) Pinto Valley Mine, Old Carlota Mine, Gibson Underground Mine, Copper Cities Mine, Miami Unit, Cyprus Miami Mine, Ray Mine, BHP Copper's Superior Underground Mine, numerous sand and gravel operations and perlite mines near Superior. Currently, mineral production is occurring primarily on land that was patented under the 1872 Mining Law or acquired through land exchange with the Forest Service.

Except for the Old Carlota Mine, Gibson Underground Mine, Copper Cities Mine, and Superior Underground Mine, all of the mining activities listed above are presently operating in the study area.

It is anticipated that the amount of land disturbance from mining will increase in the foreseeable future as the existing mines expand their operations. However, the amount of additional disturbance in the Globe-Miami Mining District is difficult to estimate and will partially depend on the existence, extent, and grade of ore, as well as on economic conditions. At present, new mining operations proposed in the area include the Carlota Copper Project (copper) and a BHP Copper open pit mine near Florence. Extensive areas within the cumulative impact study area are covered by mineral claims; periodic exploration activity has occurred and will likely continue. In addition, two existing mines (BHP Copper) Pinto Valley Mine and Cyprus Miami are considering plans or proposals for major expansions and possible land exchanges. The following information provides a brief description of the past, present, and future actions for each mining project in the study area. The locations of the mining projects are shown in *Figure 1-2* using designations M-1 through M-10.



KEY

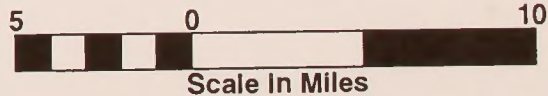
- M-1 Old Carlota Mine
- M-1 Proposed Carlota Copper Project
- M-2 Gibson Mine
- M-3 Copper Cities
- M-4 Miami Unit
- M-5 Cyprus Miami Mine
- M-6 BHP Copper Pinto Valley Mine
- M-7 Ray Mine
- M-8 Superior Underground Mine
- M-9 Placer Mining
- M-10 BHP Copper Florence

TS-1 Salt River Project
Power Line Upgrade

WR-1 Pinto Creek
WR-2 Coolidge Dam Project
WR-3 Roosevelt Dam Project

T-1 Highway 88 Improvements
T-2 Highway 60/70 Improvements

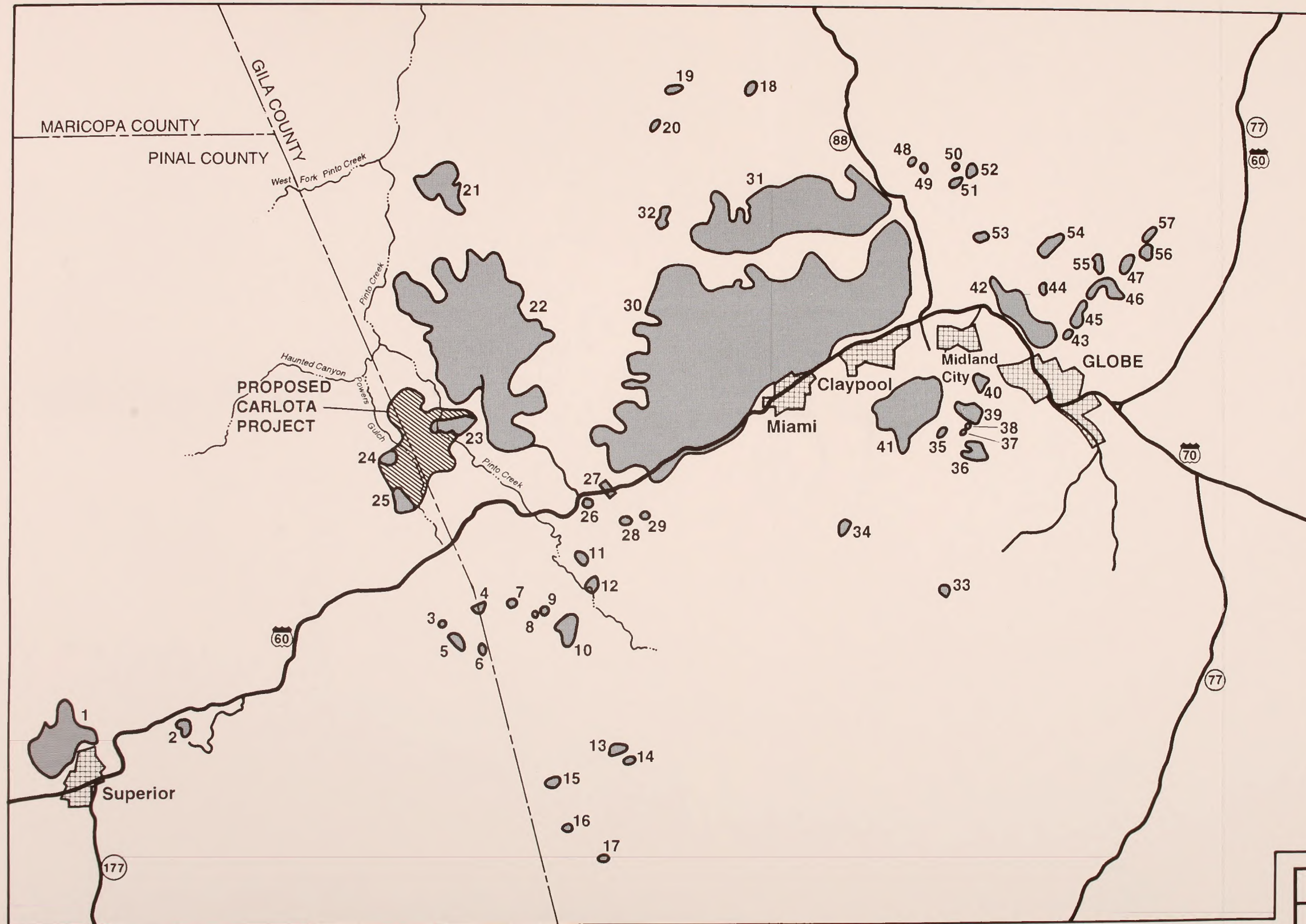
PL-1 Top-of-the-World
PL-2 Globe Area Subdivisions





 **Riverside Technology, inc.**

CARLOTA COPPER PROJECT

Figure 1-2
Location of Interrelated Actions
and Proposed Carlota Project



LEGEND

-  Mine Disturbance Areas
-  Cities, Towns


0 1 2
MILES



Note: Based on Interpretation of 1:40,000 scale
black-and-white aerial photographs taken in 1992.

Areas of Mining Disturbance

Site#	Area (acres)
1	557
2	34
3	8
4	11
5	10
6	5
7	4
8	3
9	5
10	72
11	11
12	13
13	15
14	6
15	12
16	5
17	6
18	13
19	8
20	9
21	264
22	3,320
23	138
24	34
25	60
26	6
27	19
28	8
29	5
30	7,953
31	1,921
32	36
33	8
34	29
35	14
36	61
37	8
38	7
39	98
40	49
41	812
42	371
43	25
44	21
45	50
46	130
47	32
48	6
49	7
50	10
51	20
52	30
53	36
54	66
55	26
56	24
57	14
TOTAL	16,525

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CARLOTA COPPER PROJECT

Figure 1-3

Areas of Existing Mine Disturbance
Superior - Miami - Globe Mining Districts

Table 1-2. Potential Cumulative Impacts of Interrelated Actions on Environmental Resources

Resource	Mining Projects	Grazing	Energy and Transmission System	Potential Pinto Creek Scenic River Segment	Private Land Development	Highway Development	Dam Modifications	Recreational Facilities at Roosevelt Lake
Air Resources	X				X	X		
Geology and Minerals	X					X		
Water Resources	X	X	X	X	X	X	X	
Soils and Reclamation	X	X	X		X	X		
Biological Resources	X	X	X	X	X	X	X	X
Cultural Resources	X	X	X		X	X	X	X
Socioeconomics	X	X	X		X	X	X	X
Land Use	X	X	X	X	X	X	X	X
Recreation	X	X	X	X	X	X	X	X
Wilderness Values and Wild and Scenic Rivers	X			X			X	
Visual Resources	X		X	X	X	X	X	X
Noise	X				X	X	X	X
Transportation	X		X		X	X		
Hazardous Materials	X					X		

Cities Mine, and Superior Underground Mine. Brief descriptions of these mining projects are provided below.

Old Carlota Mine (M-1). Mining production at the Old Carlota Mine was initiated between 1941 and 1948 (SWCA 1993a). The mine produced copper ore from a site that is situated approximately 8 miles west of Miami. Although much of the initial production was from subsurface areas, lessees attempted to leach the oxidized surface ore on a small scale. As a result of the high alumina content, the ore was not considered desirable by smelters. Therefore, the mine has been inactive during most of the past 35 years. Cultural resource surveys have been conducted by SWCA (1993a) to identify historic remains at the Old Carlota Mine. The Old Carlota Mine is located within the proposed Carlota/Cactus pit.

Gibson Mine (M-2). The mine is located on private land approximately 7 miles southwest of Miami. The initial mining activity was underground, and then the operation switched to in situ leaching of surface ore, which affected ground water wells in the area. The

mine is inactive, and there is currently no proposal to continue operations.

Copper Cities (Sleeping Beauty) (M-3). The Copper Cities Deposit is located approximately 3.5 miles north of Miami. Initial development activities began in 1950, and approximately 14.1 million tons of leached capping had been removed by 1953 (Peterson 1962). New facilities were constructed in 1954, and production continued until 1974. The property is currently owned by BHP Copper but is inactive at this time.

Past, Present, and Future Mining Activities

The following mines have past and present mining activities in the general study area. The project summaries also describe proposed expansions at several of these mines (Cyprus Miami and BHP Copper Pinto Valley).

Miami Unit (M-4). Mining activity for the Miami Mine (Miami-Inspiration Deposit), which is located immediately east of Miami, was initiated in 1907 by the

Miami Copper Company (Peterson 1962). The Miami Mine represented one of the first large tonnage, low-grade copper mines to begin production in Arizona. Small quantities of gold, silver, and molybdenum were also mined in the initial period of operation. The mine has continued to operate during most of the past 87 years, and it was the only major active mine in Arizona during the postwar depression. The Miami Mine was purchased in 1960 by Cities Services Company when it purchased Miami Copper Company. In 1983, Newmont Mining Company purchased Cities Services, and in 1987 Newmont spun off Magma Copper Company, which was subsequently purchased by BHP Copper in 1995. Copper is mined by in situ leaching and hydraulic processing of the No. 2 tailings from the original Miami Mine. Production in 1993 was 22 million pounds of copper.

Cyprus Miami Mine (M-5). The Cyprus Miami Mine began operation in 1912 on land situated immediately north and west of Miami. Several other historical mining lands, such as the Oxhide Deposit and the Bluebird Mine, are presently operated as part of the Cyprus Miami Mine. The production rate at the open-pit mine is approximately 127.3 million pounds of copper per year, with 213 million tons of ore reserves (Howell Publishing Company 1994). Cyprus Miami Mining Corporation has recently upgraded its smelter facility and plans to expand leaching facilities at the Cyprus Miami Mine on its patented mining claims and public lands administered by the Bureau of Land Management (BLM) and the Forest Service (Tonto National Forest). The proposed expansion includes adding new leach pads, an overburden deposition area, stormwater impoundments, solution collection and transfer facilities, and supporting roadways and power installations. A Plan of Operations was submitted to the Forest Service and the BLM in 1994, and an EIS is currently being prepared. Approval of the proposed expansion would result in continued operations for the next 17 years beginning in 1997. Cyprus Miami Mining Corporation recently completed reconstruction and expansion of its existing solvent extraction/electrowinning (SX/EW) plant for processing copper from the expansion area.

BHP Copper (Formerly Magma Copper Company) Pinto Valley Mine (M-6). The Pinto Valley Mining Company acquired patented claims in 1907 at a site that was located approximately 5 miles west of Miami.

In 1920, the Miami Copper Company acquired claims from the Pinto Valley Mining Company for gold mining and operated the Castle Dome Mine at this site from 1943 to 1949. Cities Services Company purchased Miami Copper Company in 1960 and reopened the Castle Dome Mine as the Pinto Valley Mine soon thereafter. In 1983, Newmont Mining Company purchased the holdings of Cities Services. Newmont already had a major interest in the Magma Copper Company, and in 1987 Newmont spun off its holdings in Arizona as the Magma Copper Company. This spinoff included the Pinto Valley Mine and the Miami Mine. Copper and molybdenum are produced at the Pinto Valley Mine. The mineral reserve at the mine is estimated to be 624 million tons, and the mining rate is 65,000 tons per day (Howell Publishing Company 1994). The recovery processes used are flotation and heap leaching. BHP Copper Pinto Valley Mining Company is expanding its mine rock disposal areas, tailings dams, and miscellaneous facilities over approximately 1,200 additional acres. BHP Copper, a business group of The Broken Hill Proprietary Limited, purchased Magma in 1995. BHP Copper has proceeded with plans developed by Magma and has submitted a Plan of Operations for expanding the Pinto Valley Mine pit, mine rock areas, and associated facilities. An environmental assessment on this proposal is currently being conducted. It is very likely that BHP Copper will expand other mine rock and tailings facilities sufficient to mine out the identified ore reserves. Based on an application submitted to ADEQ, BHP Copper plans to close the mine in 2007.

Ray Mine (M-7). ASARCO operates the Ray Mine at a site approximately 9 miles southeast of Superior. The majority of the mining area is located on private land. The approximate production rate at the open-pit mine is 117,300 tons of copper ore per year (Howell Publishing Company 1994). The mineral reserve in the deposit is estimated to be 609 million tons. Expansion of mine facilities is expected to allow recovery of the identified reserves. However, no specific proposal for expansion is available.

Superior Underground Mine (M-8). The Superior Mine was the original mine of Magma Copper Company. The mine operated from 1912 to 1982 when it closed because of low copper prices. It reopened in 1990 under the same ownership, but Magma was acquired by BHP Copper in 1995. The mine, which has a production rate of 1,000 tons of ore

per day, closed in 1996 when proven ore reserves were exhausted. Exploration to identify additional underground ore reserves is continuing.

Placer Mining in Pinto Creek (M-9). Recreational panning and small-scale placer mining presently occur in a section of Pinto Creek from the area of the proposed Carlota Copper Project downstream for approximately 15 miles to below the Henderson Ranch property. The activity is generally limited to those sites with road access.

Potential New Mining Activities

The most foreseeable new development in the general study area is the Florence Project (M-10). A pre-feasibility study was being conducted by Magma at the time it was acquired by BHP Copper. The study indicates potential for an open-pit or in situ leached copper mine near Florence. The size of the proposed project area would be small for the in situ process and approximately 1,200 to 1,900 acres for an open-pit mine. If the project is considered feasible and approved, the overall schedule to complete the mine construction is 3 to 5 years. The estimated workforce to operate the project is 300.

The cumulative impact study area is heavily mineralized and contains numerous patented mining claims (private property), as well as claims under the mining laws. No proposals for other new mines were identified, but it is reasonably foreseeable that new proposals will be developed in the future.

1.6.2.2 Grazing

Essentially all of the National Forest land in the Pinto Creek watershed is currently managed for year-round cattle grazing. In recent years, the Forest Service has enacted changes in range management practices on some of the grazing allotments to improve range conditions. These changes have included implementing rest-rotation programs, constructing cattle fencing, and reducing the total number of cattle grazed in some allotments. It is anticipated that grazing will continue to be an important land use in the area for the foreseeable future. The direction in range management on the Tonto National Forest is to bring the permitted number of livestock in line with the grazing capacity of each allotment (USDA Forest Service 1985). The following assumptions have been

made regarding future grazing in the Tonto National Forest (USDA Forest Service 1985):

- Demand for grazing will remain high and is expected to exceed the available supply.
- Demand for recreational horse forage will continue to increase in conjunction with increased recreational use.
- Conflicts will decrease between grazing and other resource uses as permitted use comes into line with capacity and improved management is implemented.

As discussed in the Land Use section (Section 3.8) of this EIS, there are six existing Forest Service grazing allotments in the vicinity of the Carlota Copper Project: the Bohme, Bellevue, Hobbs, Devils Canyon, Pinto Creek, and Brushiest allotments. The Brushiest allotment is currently ungrazed by livestock, and is not scheduled to be grazed until such time as further analysis is completed to determine feasibility. The Forest Service recently completed Allotment Management Plans for the Bellevue and Bohme allotments that included rest-rotation methods of grazing. Essentially all of the National Forest land in the Pinto Creek watershed is currently managed for year-round grazing, although non-use agreements are in place for two allotments at this time.

1.6.2.3 Energy and Transmission Systems

The increased demand for electrical power will continue for ongoing and future mining activities and other commercial and residential development in the Globe-Miami area. The demand will be fulfilled by constructing new transmission lines and distribution lines, as well as new substations, and upgrading existing transmission lines and substations. Power for the area is supplied by the Salt River Project and Arizona Public Service. In addition to the proposed substation and associated facilities to supply the Carlota Copper Project, the only other proposed energy project is the Salt River Project Power Line Upgrade. This project would involve reliability maintenance improvements on a section of a 115-kv transmission line that runs between Superior and Ray (TS-1 in *Figure 1-2*). The construction was completed in 1995.

1.6.2.4 Water Resources Projects

Pinto Creek Wild and Scenic River Designation (WR-1)

At the request of the Arizona Congressional delegation, the Forest Service completed a statewide inventory of rivers potentially eligible for inclusion in the National Wild and Scenic Rivers System. The preliminary analysis of this inventory resulted in an 8.8-mile segment of lower Pinto Creek, beginning 5 miles below the proposed Carlota Copper Project, being classified as scenic and potentially eligible for inclusion. The suitability determination was not completed. The Pinto Creek segment has not been proposed for designation, but will be evaluated by the Tonto National Forest during the next *Tonto National Forest Plan* revision.

If Pinto Creek were eventually designated for inclusion within the Wild and Scenic River System, changes in management practices for this river segment would occur. The actual management standards would depend on the final classification of the river segment (e.g., wild, scenic, or recreational). Regardless of classification, the principal effect of the Wild and Scenic Rivers Act is to preclude or severely limit the construction of dams or other projects that might affect the free-flowing nature of the river and its associated resources (e.g., aquatic community, recreation, etc.). In addition, the federal government can consider acquiring private lands, if necessary, to protect the value of the river corridor or to provide public access. The designation would have no direct effect on existing water rights; however, existing water rights could be purchased by the federal government, if necessary, to meet instreamflow requirements, or negotiated agreements could be arranged with the water users to provide for specific instreamflows. The Forest Service currently has an instreamflow water right permit for most of the eligible segment of the stream. This right ranges from 0.8 to 2.7 cubic feet per second (cfs) depending upon the month, and has a priority date of 1983.

Coolidge Dam Project (WR-2)

The Bureau of Reclamation (BOR) recently upgraded the safety of the Coolidge Dam on San

Carlos Reservoir by putting concrete on the downstream right and left abutments. The dam and reservoir are located within the San Carlos Indian Reservation. Construction was initiated in 1994 and completed in 1995. All economic activity related to construction has returned to pre-project conditions. The project resulted in minor temporary disturbance within the construction area; however, no additional disturbance occurred downstream along the Gila River, and risk of damage from dam failure has been greatly reduced.

Roosevelt Dam Modifications (WR-3)

The BOR recently improved the safety of Roosevelt Dam on Roosevelt Lake by raising the dam structure 77 feet, including an increased depth of 17 feet for the conservation pool and 60 feet for flood storage. The increased conservation pool may result in the periodic inundation of approximately 1,862 acres of land located within the upstream impoundment area. The construction associated with the dam was essentially completed in 1996. The workforce, which averaged 180 to 190, with a peak of 200 to 250, has now returned to near pre-project conditions.

In addition to the Roosevelt Dam modifications, the following recreation projects have been, or are in the process of being, constructed in the Roosevelt Lake Recreation Area and will be completed by 1997: Grapevine Group Site, Windy Hill Recreation Site, a visitor center, a new marina, new boat access sites, Cholla Campground, Schoolhouse and Indian Point Campgrounds, new picnic areas at Vineyard and Carson's Landing, and new vista points at Alchesay Canyon and Inspiration (BOR 1990). Except for the new marina (construction from 1994 to 1999), the recreation projects will be completed by 1997. The majority of the work, in terms of expenditures (\$50 million) and workforce (approximately 100 workers), has been, and will be, from 1992 to 1996.

1.6.2.5 Transportation

Future improvements are in the planning stages for State Highway 88 (1996-1997 fiscal year) from the Tonto National Monument to the U.S. Highway 60

junction. State Highway 88 (T-1) will be upgraded from two to four lanes, and some segments will be relocated. Construction for these improvements will occur after 1997. The Arizona Department of Transportation (ADOT) has also proposed improvements to the U.S. Highway 60-70 system (T-2), and the following improvements have been approved: widening the shoulder of a 0.5-mile section of the Devil's Canyon segment (1993-1994), lengthening the Carrizo Climbing Lane (1994-1995), improving 13 miles of road near the Superior-Tonto National Forest Boundary (1995-1996), and improving the road entrance to the Boyce Thompson State Park (1996-1997) (ADOT 1993). The estimated workforce to complete these projects is 30 to 50. Other planning activities for improving the U.S. Highway 60-70 system will occur from 1994 through 1997; implementation will take place after 1997.

1.6.2.6 Private Land Development

The development of undisturbed private land for residential or commercial purposes is occurring in several areas, including the areas around Top-of-the-World (PL-1), Globe (PL-2), Superior, and the San Carlos Indian Reservation, and, to a limited extent, smaller parcels of land such as those near Roosevelt Lake. Discussions with the Pinal County Planning Manager indicated that a limited number of lots are available for the Top-of-the-World community. Housing development is also likely to occur in the Globe-Miami area, and to a lesser extent near Superior. Other types of private development that have recently been completed or are planned include businesses associated with the tourism or service industries and a casino on the San Carlos Reservation (approximately 8 miles east of Globe).

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.0 Alternatives Including the Proposed Action

This chapter describes the proposed Carlota Copper Project as developed by the Carlota Copper Company, a range of reasonable project alternatives analyzed in the EIS, and a list of other potential alternatives that were considered but eliminated from detailed analysis. This chapter also includes a comparative impact analysis of the project alternatives and identifies the Forest Service's preferred alternative.

The proposed action analyzed in this EIS is the "applicant's preferred alternative" for the CWA Section 404 Permit evaluation. The CWA Section 404(b)(1) alternatives analysis is provided in Appendix A, Section 404 Permit Alternatives Analysis, and is cross-referenced in this chapter.

2.1 Proposed Action

2.1.1 Overview of Proposed Carlota Copper Project

A complete description of the proposed project is found in the Carlota Copper Company Plan of Operations (Carlota 1992), the Update to the Plan of Operations (Carlota 1993a), *Carlota Copper Project, Final Design of Heap Leach Pad and Ancillary Facilities* (Knight Piésold 1995a) and numerous technical documents, plans, and memoranda prepared by Carlota and its consultants, all of which have been submitted to the Tonto National Forest. The following project description summarizes this information.

The Carlota Copper Project area is characterized by mountainous terrain covered with chaparral vegetation common to the area. The climate is mild with long frost-free periods and temperatures that range from approximately 20°F to over 100°F. Annual precipitation averages approximately 24 inches. Dominant land uses in the project area are mining, livestock grazing, recreation, and wildlife habitat. The project area is dissected by two drainages, generally running southeast to northwest. Pinto Creek, the larger of the two, is located on the east side of the project area; Powers Gulch is on the west side. Project facilities are proposed in both drainages.

Proposed project facilities include three open pits, three surface mine rock disposal areas, a heap-leach pad and the associated SX/EW process plant, and administrative facilities. The proposed Carlota/Cactus pit, the largest of the pits, would contain 80 percent of the project's ore reserves and would span Pinto Creek. A permanent diversion channel would be incorporated in the pit design to carry the creek flow around the east and north side of the pit. The proposed Eder North and South pits would be located on the west side of Powers Gulch. The Eder South pit includes a separate, very small pit (Eder Middle pit), which is considered an extension of the northwest corner of the Eder South pit. Volume and area estimates presented for the Eder South pit include this small area. The heap-leach pad would be located in Powers Gulch and would be designed as a valley leach. Powers Gulch would be permanently diverted around the west side of the heap-leach facility. The leach solutions would be collected in the pad itself, behind embankments at the downstream ends of the pad. The SX/EW plant would be located on the ridge that divides the Carlota/Cactus pit from the leach pad. Other project features include access/haul roads, a power line, water supply facilities, a mine shop, a warehouse, and an administration building. The total area disturbed by all of the proposed project features would be approximately 1,428 acres.

2.1.1.1 History of the Area

The Carlota Copper Project is located at the west end of the Globe-Miami Mining District. The Globe-Miami Mining District is one of the oldest and largest in Arizona and has witnessed the transition from underground mining of high-grade veins in the 1870s to current surface mining operations at several low-grade copper-porphyry deposits. Mining and exploration work within the Carlota Copper Project area was of a sporadic and limited nature prior to the 1989 acquisition of the project properties by Westmont Mining Inc.

Relatively minor production from the Carlota deposit during the early to mid 1900s was restricted to a small, open cut and related underground workings that exploited ore along the Kelly fault. During the early 1930s, a small agitation vat-leaching

operation—remnants of which can be seen today—was carried out on the property. In the late 1960s, the property was leased by Homestake Production Company (Homestake), which drilled a total of 25 core holes. While Homestake's primary objective was evaluating ore in the Kelly fault, it also discovered mineralization within the hanging wall of the fault. This latter mineralization is referred to as the Cactus Breccia and is contiguous with mineralization on the adjacent Cactus deposit. After Homestake dropped the property in the early 1970s, a venture of two Canadian companies, headed by Sonesta Resources (Sonesta), drilled an additional 14 core holes. The holes were drilled primarily to further define the extent of the breccia-type ore. Sonesta dropped the property in 1975, and it was effectively inactive until Westmont leased the property in 1989.

Activity at the Cactus deposit also dates back to the early 1900s. By the early 1920s, several shafts had been sunk on the property with extensive lateral workings, and at least 30 rotary holes were drilled. At that time, a small mineralized body was defined but never mined. The property remained largely inactive until the period from 1960 to 1970. At that time, the property was owned by Cities Service Company, which drilled numerous additional rotary holes on the deposit. After purchasing the Cities Service Company holdings, Magma Copper Company drilled a total of 39 core holes from 1987 to 1988.

The Eder-Ghost claim block was assembled by Inspiration Copper Company (Inspiration) during the mid-1960s/mid-1970s under a joint venture with Anaconda. Anaconda dropped out of the venture in 1974, but Inspiration retained the property until it was purchased by Cyprus in 1988. Inspiration acquired the original claims staked by Carl Eder and located additional claims, all of which were subsequently surveyed for patent in the early 1970s. Several old shafts and adits on the property probably date from the early 1900s, but the first extensive drilling on the property dates to the mid-1950s by the Howe Sound Company. Inspiration drilled a total of 12 rotary holes and 32 core holes on the property, primarily from 1968 to 1975, and the majority of the holes defined the Eder North and South deposits. Only assessment-type activities have been undertaken since 1976. Cyprus sold the property to Westmont because

it considered the property too small and remote from its current operations to justify development.

2.1.1.2 Exploration and Development Drilling

Exploration and development drilling on the Carlota, Cactus, and Eder properties by Westmont Mining Inc. from 1989 to 1991 led to the definition of a copper ore deposit amenable to heap-leach/SX/EW technology. Cambior Inc. acquired the Carlota Copper Project and Westmont Mining Inc. and established the Carlota Copper Company in August 1991 to operate and manage the project. Carlota immediately initiated an aggressive exploration and drilling program both to expand reserves and develop the property. This recent work defined proven reserves estimated at 100.3 million tons of ore in the three deposits (Carlota/Cactus, Eder North, and Eder South pits), which established the viability of the project.

2.1.1.3 Geology, Mineralization, and Ore Reserves

Principal rock types within the Carlota Copper Project are, from oldest to youngest, the Precambrian Pinal Schist (the main ore host at the Eder South deposit), Precambrian Diabase, Laramide-age Schultze Granite, mid-Tertiary Cactus Breccia (the main ore host at the Carlota/Cactus and Eder North deposits), mid-Tertiary Apache Leap Dacite, and late Tertiary Gila Conglomerate.

The most significant ore-bearing rock type within the project area is the Cactus Breccia, which is thought to represent subaerial landslide deposits shed from the altered and oxidized Pinal Schist adjacent to the Pinto Valley copper deposit. The breccia is composed of quartz-rich schist fragments of widely variable sizes (1 inch to 100 feet) in a red, hematite-rich sand and silt matrix. The breccia is depositionally overlain by the Apache Leap Dacite.

Up to 700 feet of breccia and dacite are preserved within the northwest-trending Carlota Graben, which is defined to the south by the steeply dipping mineralized Kelly fault zone and by a parallel fault to the north. Within the graben, the low-angle Cactus fault separates the Cactus Breccia from the underlying Pinal Schist. Mineralization at the

Carlota/Cactus deposit is hosted within the Cactus Breccia and immediately overlying dacite and is generally confined by graben-bounding faults. The deposit is approximately 3,600 feet parallel to and 1,000 feet away from the Kelly fault and is often 400 to 600 feet thick.

A series of northwest-trending faults has intensely fractured the Pinal Schist, which hosts mineralization at the Eder South deposit over an area some 2,400 feet north-south, 1,000 feet east-west, and 200 to 300 feet thick. Mineralization at Eder North is restricted to an approximately 1,000-foot-wide area within a west-trending channel cut into Pinal Schist and is filled with Cactus Breccia.

With the exception of the lower and more easterly part of the Cactus deposit, there are no known sulfide minerals present in any of the deposits. In the sulfide-rich area of the Cactus, secondary chalcocite is found replacing or partially rimming pyrite that is present as veinlets within breccia clasts.

The current drill-hole database used to calculate reserves at the three major deposits (including the Eder Middle deposit) consists of approximately 291 drill holes. Average drill-hole spacing through the mineralized areas is approximately 200 feet or less, allowing for the calculated reserves to be classed as proven/probable.

Current proven/probable mineable reserves at the Carlota Copper Project are summarized in *Table 2-1*.

Table 2-1. Summary of Mineable Reserves

Pit	Ore (ktons)	Mine Rock (ktons)	Total Material (ktons)	Strip Ratio Mine Rock: Ore
Carlota/Cactus	80,800	193,700	274,500	2.4
Eder South	16,300	11,400	27,700	0.7
Eder North	3,200	6,200	9,400	1.9
TOTAL	100,300	211,300	311,600	2.1

Notes: ktons equals short tons times 1,000.
Ore cutoff = 0.15 percent total copper grade.
Eder South pit includes small Eder Middle pit.

2.1.1.4 Site Plan and Major Project Components

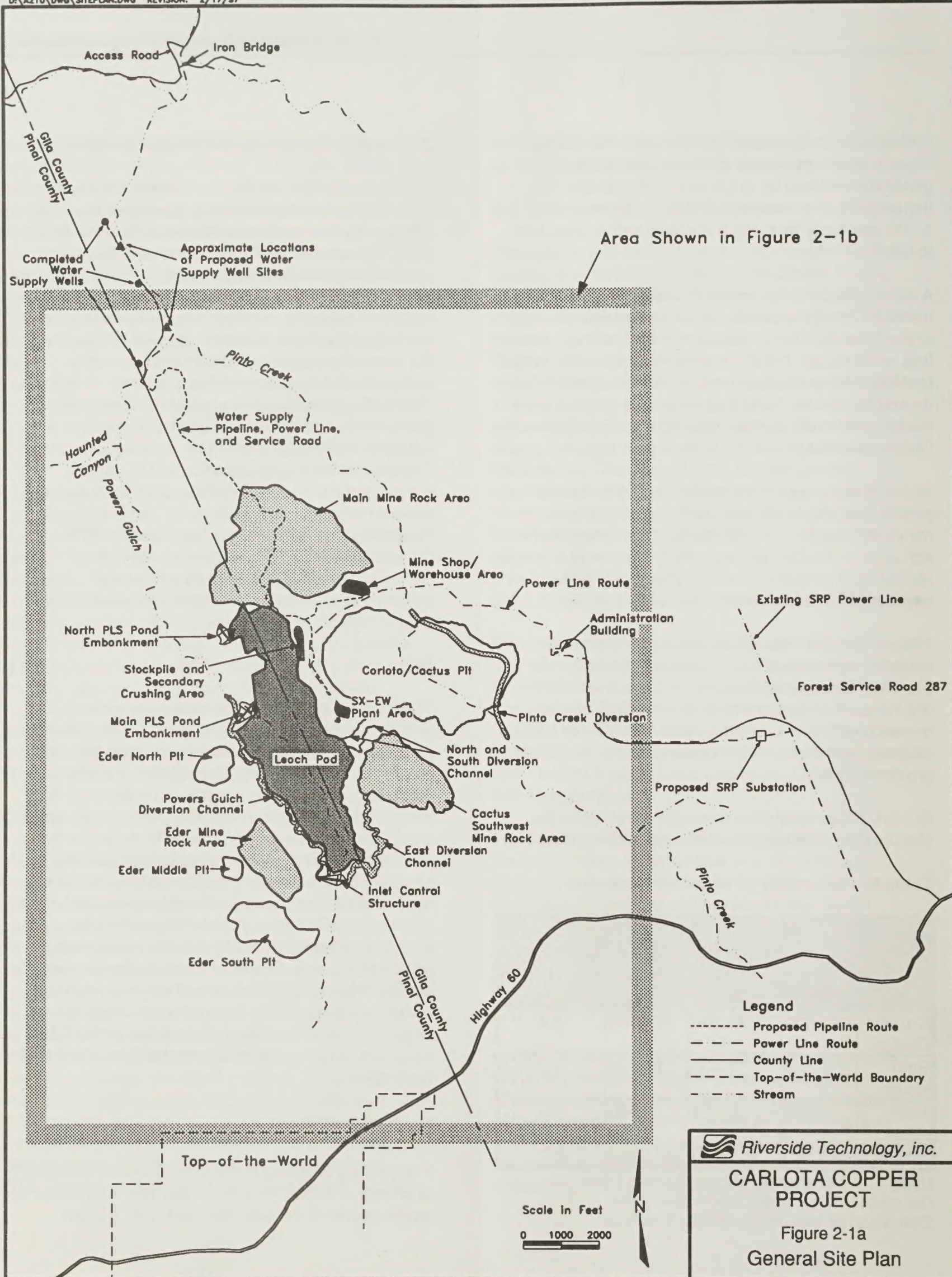
The proposed Carlota Copper Project is an open-pit copper mining and processing operation. A site plan of the proposed facilities is shown in *Figures 2-1a and 2-1b*. The approximate affected area of the major project components is summarized in *Table 2-2*. Two tabulations are included; the first is the area of the outline of the component as it appears on the project site plan (*Figures 2-1a and 2-1b*), and the second is the area of the component with a buffer zone, nominally 100 feet, around the outline of the feature. This buffer zone includes most of the area between the pit limits and the mine rock disposal areas, since this area would be disturbed by mine access roads. The area of the feature plus the buffer area is considered the potentially affected area for impact assessment purposes. This buffer zone also includes the entire ridge between the leach pad and the Carlota/Cactus pit. The coarse-ore stockpile, secondary crusher, SX/EW, plant site, and connecting access roads would be located in this area.

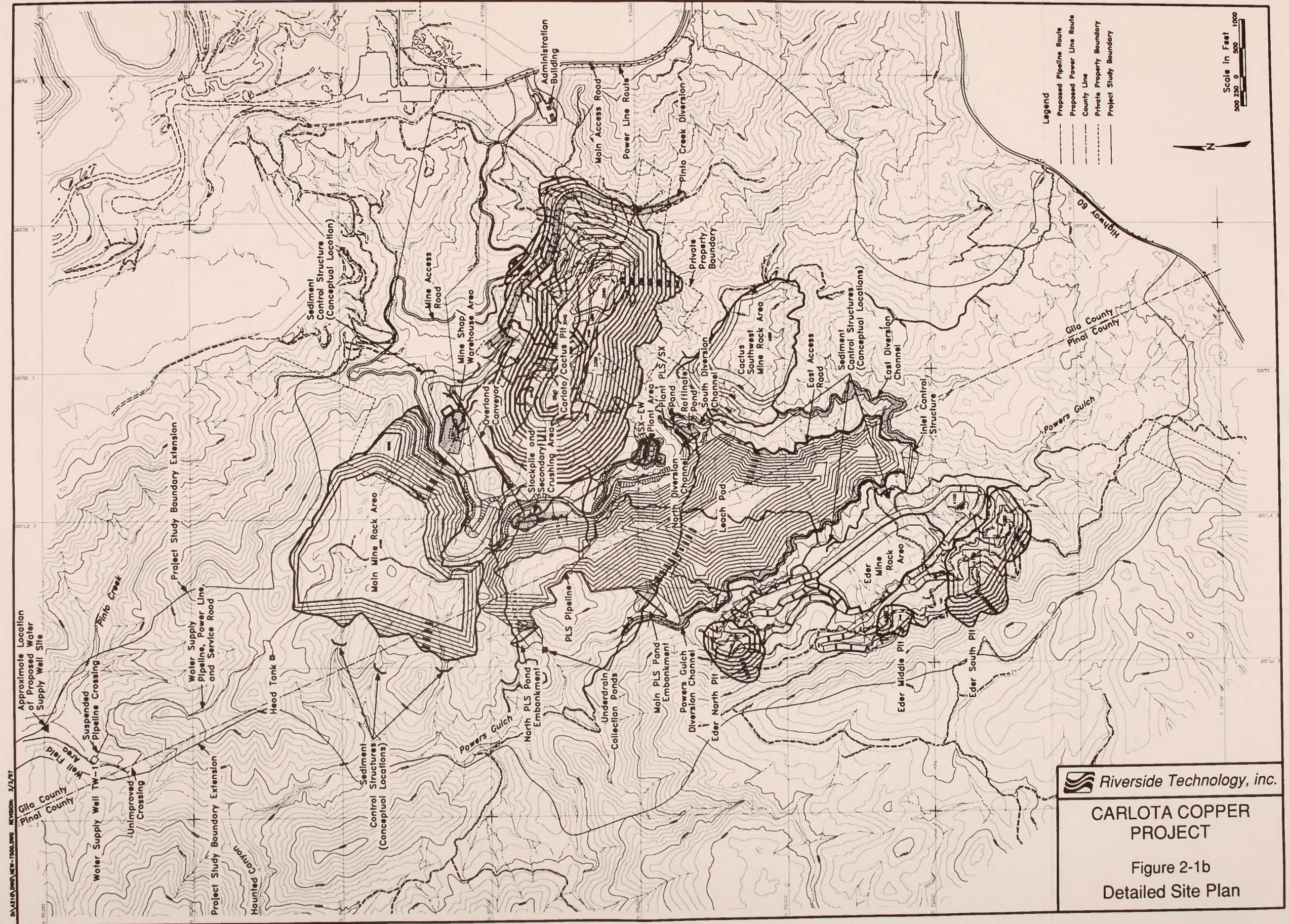
Mining

The ore would be mined using conventional techniques, including blasting, truck hauling from the pit to the crusher, and conveyor transport from the crusher to the leach pad. The Carlota and Cactus orebodies, estimated to contain approximately 80.8 million tons of ore, would be mined as a single pit; a diversion would be constructed in Pinto Creek to convey the stream around the pit. Mine rock from this pit would be deposited in the Main mine rock area northwest of the pit and the Cactus Southwest mine rock area south of the pit. In addition, Carlota proposes to partially backfill the Carlota/Cactus pit with mine rock. The Eder pits together contain an additional 19.5 million tons of ore and would be mined as separate pits during the latter half of the project life; mine rock would be hauled to the Eder mine rock area located between the Eder North and South pits.

Processing

The primary crushing facilities would have a capacity of at least 7 million tons of ore per year and would be located north of the Carlota/Cactus pit with an





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CARLOTA COPPER PROJECT

Figure 2-1b
Detailed Site Plan

Table 2-2. Proposed Carlota Copper Project Acreages

Major Project Component	Acres Affected (component footprint plus buffer)	Acres Affected Under Project Component Footprint	Buffer Zone Acreage by Component	Approximate Acreage to be Revegetated per Reclamation and Closure Plan		
				Component Footprint	Buffer	Total
Open Pits						
Carlota/Cactus Pit	320	284	36	48	36	84
Eder North Pit	34	24	10	7	10	17
Eder South Pit (includes small Eder Middle pit)	81	59	22	26	22	48
SUBTOTAL - Open Pits	435	367	68	81	68	149
Mine Rock Disposal Areas						
Main Disposal Area	227	199	28	106	28	134
Cactus Southwest Disposal Area	100	74	26	45	26	71
Eder Disposal Area	73	61	12	28	12	40
SUBTOTAL - Mine Rock Disposal Areas	400	334	66	179	66	245
Leach Pad (includes diversions and inlet control structure)	313	300	13	270	13	283
Process Area						
SX/EW Plant Area	23	8	15	8	15	23
Raffinate and Plant PLS/SX Ponds	6	2	4	2	4	6
SUBTOTAL - Leach Pad/Process Plant Area	342	310	32	280	32	312
Water Supply Area						
Well Field	2	2	0	2	0	2
Water Pipeline, Access Roads, and Power Line	6	6	0	6	0	6
SUBTOTAL - Water Supply Area	8	8	0	8	0	8
Ancillary Project Components						
Mine Shop, Main Disposal Area Haul Road, Crusher/ Conveyor/Stockpile Areas	76	25	51	21	51	72
Eder Area Access Road	19	19	0	15	0	15
Eder Area Mine Roads	101	101	0	101	0	101
Administration Building/ Parking	6	2	4	2	4	6
Main Access Road (county road to admin. area)	4	4	0	3	0	3
Mine Access Road (admin. area to Pinto Creek)	12	12	0	8	0	8
Miscellaneous Project Area Roads and Power Line	25	25	0	19	0	19
SUBTOTAL - Ancillary Project Components	243	188	55	169	55	224
GRAND TOTAL	1,428	1,207	221	717	221	938

Source: Carlota (1993a)

overland conveyor to the coarse-ore stockpile and secondary crusher. A portable crusher would be temporarily located at the mouth of the Eder South pit; crushed ore from the Eder pits would be either hauled by truck or conveyed to the leach pad. The ore would be crushed to an average size range of less than 2 inches.

The leach pad would be located in Powers Gulch and would have a capacity of at least 100 million tons. The Powers Gulch drainage would be diverted around the leach pad where the ore would be cured with a sulfuric acid solution. The ore would be leached using raffinate (barren, non-copper-bearing solution) recirculated from the SX/EW plant. The raffinate pond would be located south of the processing plant and directly upgradient from the leach pad. The raffinate would be dripped or sprayed on the pad, and the pad itself would collect the copper-bearing leach solution, commonly referred to as pregnant leach solution, or PLS.

The SX/EW plant would have a design flow rate of approximately 6,000 gallons per minute (gpm). The PLS would be pumped through the SX/EW plant to produce high-quality copper cathodes.

Water Supply

An average of approximately 590 gpm of water would be required for the operation, with a higher average demand of approximately 850 gpm during typical dry months. Water would be used to account for leach evaporation and ore adsorption losses, plant and mine shop supply, dust control, and a potable supply. These water requirements were based on a revised water balance developed during the final engineering design of the leach pad (Knight Piésold 1995a). The leaching operation would be operated under the criteria used in this water balance, which includes using drip emitters as the preferred method of applying leach solutions in dry months. Using sprays would be reserved for times when evaporation of excess solution is required. This water would be supplied by dewatering the pits and installing water supply wells in the Pinto Creek basin. The water supply well field would be located along Haunted Canyon and Pinto Creek, approximately 2 miles north of the SX/EW plant (*Figure 2-2*). This water supply would require the construction of an access road, a

pipeline, an overhead power line, and associated pumping equipment to transport the water from the Pinto Creek basin to the project site.

Field tests of three water supply test wells indicate that pumping rates ranging from 75 to 600 gpm per well can be achieved. These rates, along with pit dewatering well rates, are sufficient to supply the mine's average and peak water demands. In total, the water supply facilities would disturb approximately 8 acres for well sites, a pipeline, a pump station, a power line, access roads, and a storage tank.

Infrastructure

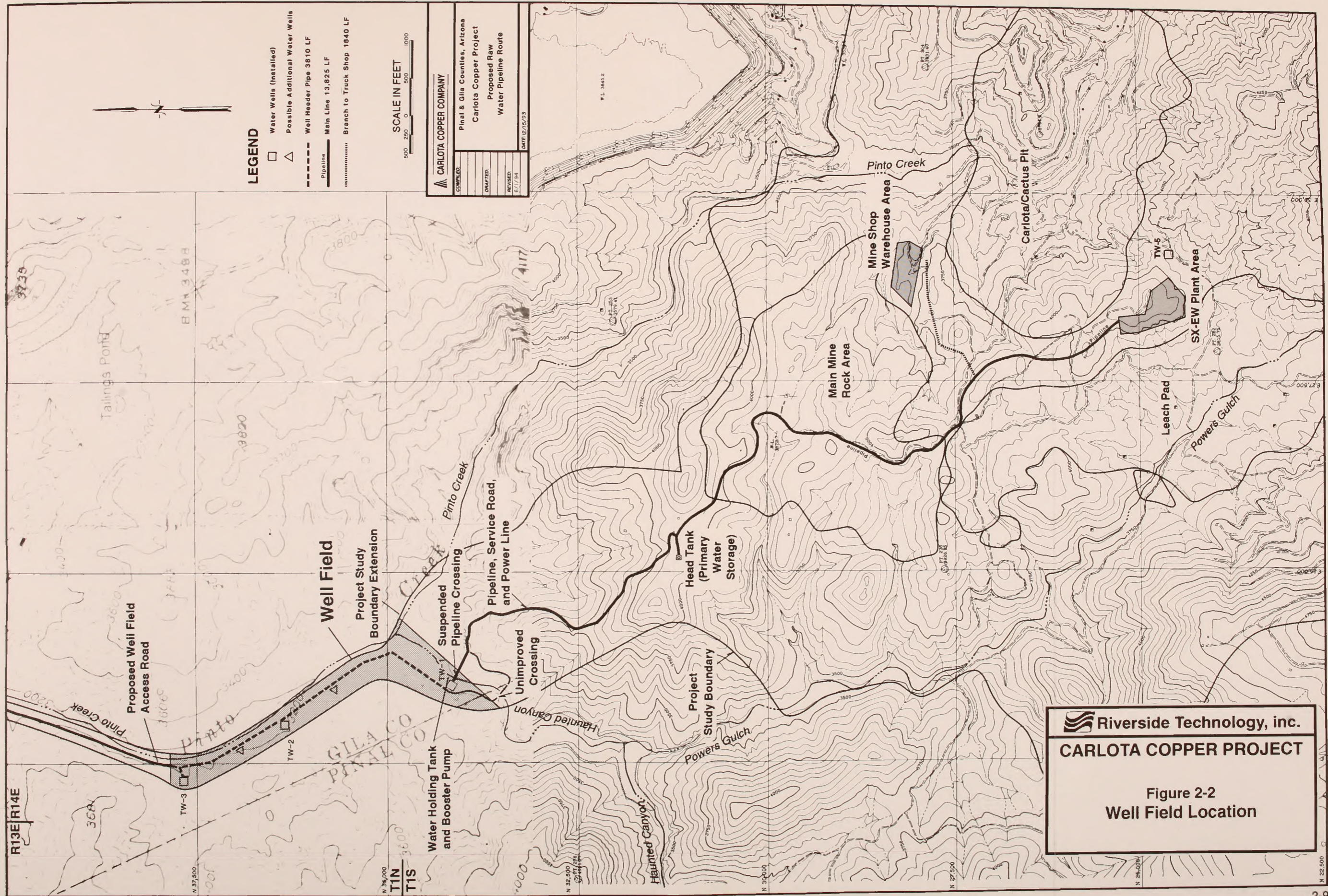
Additional project facilities would include access and haul roads; an electrical substation; power lines; an equipment maintenance shop and warehouse; administration office and laboratory buildings; water, fuel, and reagent storage tanks; and sewage treatment/disposal systems.

Reclamation

The objectives of the reclamation program are to minimize public safety hazards, ensure long-term protection of the environment, and reclaim the site for livestock grazing, wildlife habitat, and other resource values. Reclamation would include closing the leach pad in compliance with federal and state regulations, removing roads and structures, stabilizing pits, protecting natural stream channels and diversion channels, and recontouring and revegetating disturbed areas where feasible.

2.1.1.5 Production Schedule and Manpower Requirements

Project construction is scheduled to begin in 1997 and would employ up to 177 workers over the 8- to 10-month construction period. Commercial production of copper would begin in 1998, and the project employment would average approximately 282 with a maximum of approximately 301 workers. Mining operations are scheduled to continue for approximately 15 years; leaching and economic recovery of copper would continue for up to 5 additional years; and mine closure and reclamation would continue for approximately 2 to 3 years, following the end of operations. Mining and processing



operations would run 24 hours per day, 7 days per week. Preproduction stripping and ore-mining operations would start during the construction period.

2.1.1.6 Future Operations

No future mining operations are currently proposed for the project area following the closure and reclamation of the Carlota Copper Project.

2.1.2 Mining Operations

This section summarizes the major features of the mining operation for the Carlota Copper Project and a reasonable sequence for the development of the Carlota/Cactus, Eder North, and Eder South pits based on Carlota's current mine planning. The material quantities are presented as typical for total volumes of ore and mine rock and for yearly quantities, as presented in the summary schedules. The mineable ore reserves and the associated volumes of mine rock are based on foreseeable copper prices and operating costs. While the mine planning is detailed enough to characterize the mine operations for the EIS, the quantities presented in the following sections are approximate. Reasonable fluctuations can be expected in the scheduled activities, total volumes of material, and annual quantities of material moved through the life of the mine because of modified pit designs and refinements and changing economics.

2.1.2.1 Open Pits

Three open pits (including the Eder Middle pit as an extension of the northwest corner of the Eder South pit) would be developed during the proposed project life. The Carlota/Cactus pit, the largest, contains approximately 80.8 million of the total 100.3 million mineable ore tons of the project. The Carlota/Cactus pit would be located on the east side of the proposed project area, oriented in a southeast-northwest direction, and would span Pinto Creek. The location of the orebodies within the proposed pit include the northwest portion for the Carlota ore and southeast portion for the Cactus ore. A diversion channel would be incorporated into the mine plan to divert the creek around the east and north side of the pit. The pit

would be approximately 5,000 feet long by 3,200 feet wide, and the ultimate pit-bottom elevation would range from approximately 2,950 to 2,850 feet above mean sea level (ft-amsl) (i.e., 500 to 650 feet below the present elevation of Pinto Creek). An area in the eastern portion of the mined-out pit along the western side of the Pinto Creek diversion channel would be backfilled to an elevation of 3,600 ft-amsl (approximately 80 feet above the present elevation of Pinto Creek, which is approximately 3,520 ft-amsl) to buttress the in-pit side of the diversion channel. The Eder pits would be much smaller than the Carlota/Cactus pit and would be on the slope that forms the west side of Powers Gulch. These pits would be side-hill cuts and would not be as deep as the larger Carlota/Cactus pit.

In the proposed mining schedule, the Carlota/Cactus pit would be mined in five phases, the Eder South pit in at least three phases, and the Eder North pit in a single phase (*Table 2-3*). In general, the higher-grade Carlota/Cactus pit would be mined first, and the lower-grade Eder pits would be mined in the later years of the project. Under the current development schedule, mining would begin in the Cactus area comprising the southeast portion of the ultimate pit and would move through the five phases of the Carlota/Cactus pit to the northwest.

The only break in ore production from the Carlota/Cactus pit would occur in project Year 9. At that time, 4 to 5 million tons of ore would be mined from the first phase of Eder South, which would allow time for prestripping in the last two phases of the Carlota/Cactus to proceed. Ore mining in the Carlota/Cactus pit would be completed at the end of Year 12, with production from the Eder pits occurring during the last 2.5 years of the project.

The design of the first phase of the pit includes additional stripping to push back the pit wall in order to place the Pinto Creek diversion channel on a bench in the pit. Preproduction stripping would occur during construction (Year 0). Project Year 1 would be the first full year of ore mining and copper production. The schedule was developed at a nominal production rate of 7 million tons of ore per year, with adjustments up and down to attempt to stabilize copper production at approximately 33,000 annual tons. The 7 million tons of ore per year equate to a daily production

Table 2-3. Anticipated Mine Production Schedule

Project Year	Prestrip in Pit/Phase	Mining in Pit/Phase	Ore (ktons)	Mine Rock (ktons)	Total Material (ktons)
PP	CC-1		1,400	8,000	9,400
1		CC-1	7,000	17,000	24,000
2	CC-2	CC-1	7,000	17,000	24,000
3	CC-3	CC-1&2	6,700	17,300	24,000
4		CC-2&3	7,000	17,000	24,000
5		CC-2&3	7,000	17,000	24,000
6	CC-4&5	CC-3	7,000	17,000	24,000
7	CC-4&5	CC-3	7,000	17,000	24,000
8	CC-5/Eder S	CC-3	7,000	17,000	24,000
9	CC-5	CC-3&4 Eder S	7,000	19,000	26,000
10		CC-4&5	7,000	19,000	26,000
11	Eder S	CC-5	7,000	12,000	19,000
12	Eder S	CC-5	6,900	7,000	13,900
13	Eder S	CC-5 Eder S	6,000	1,900	7,900
14	Eder N	Eder S	6,000	5,500	11,500
15		Eder N	3,300	2,600	5,900
TOTAL			100,300	211,300	311,600

PP = Pre-production

CC = Carlota/Cactus pit

Eder N = Eder North pit

Eder S = Eder South Pit

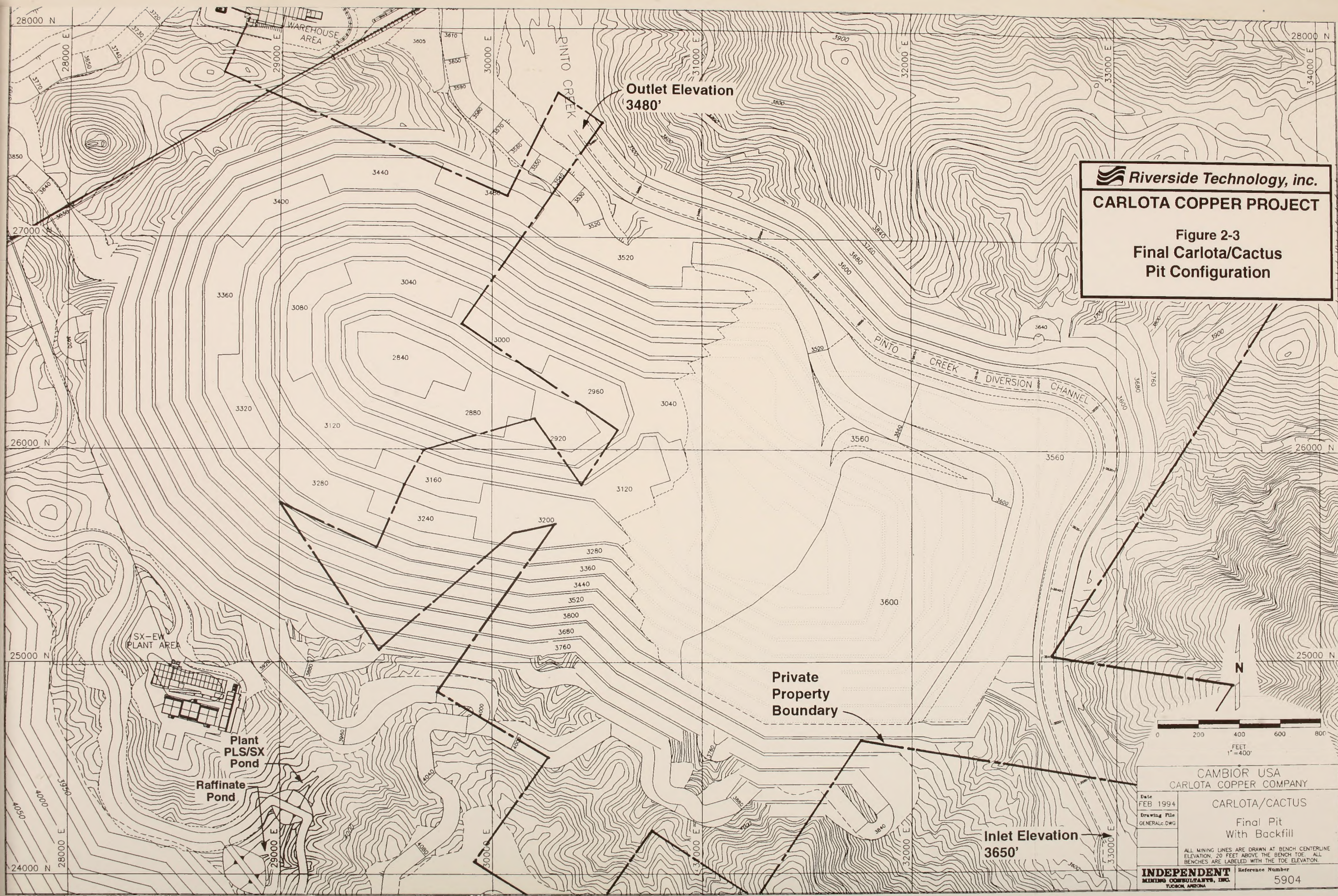
rate of approximately 20,000 tons. Total material moved during the first 8 project years would average approximately 24 million tons per year (an average of approximately 69,000 tons per day) and would increase to 26 million tons per year in project Years 9 and 10.

2.1.2.2 Mine Rock Disposal Areas

Three surface mine rock disposal areas and partial backfill of the Carlota/Cactus pit are proposed during the life of the mining operation. Two of the surface disposal areas and the pit backfill would be used for the Carlota/Cactus mine rock, and one surface disposal area would be used for the mine rock from the Eder pits. The disposal areas for the Carlota/ Cactus mine rock would be the Main mine rock disposal area in the drainage area northwest of the pit, with a capacity of 115 million tons and a final top elevation of 4,160 ft-amsl (Carlota 1994a); the Cactus Southwest mine rock disposal area in a small drainage southwest of the pit, with a capacity of 27.5 million tons (top elevation of 4,360 ft-amsl); and the Cactus pit backfill in the eastern end of the Carlota/Cactus

pit, with a capacity of 51.5 million tons (top elevation of 3,600 ft-amsl). The Eder mine rock disposal area, located on the slope between the Eder North and South pits, would have a capacity of 17.1 million tons (top elevation of 4,240 ft-amsl). The surface mine rock disposal areas are presented in the general site plan (*Figures 2-1a and 2-1b*) and the final Carlota/Cactus pit configuration is presented in *Figure 2-3*.

In the proposed production schedule, Phase 3 in the Carlota/Cactus pit would be completed by the beginning of project Year 9, and backfilling of the area mined during the first three phases of the pit would begin at that time. Mine rock from the last two phases of the Carlota/Cactus pit would be hauled to the backfilled pit area during Years 9 through 13. The backfill material would be placed in the eastern portion of the mined-out pit along the western side of the Pinto Creek diversion channel. The backfill would buttress the in-pit side of the diversion channel, raise the elevation of the Cactus pit bottom, and reduce the amount of material otherwise destined for the Main mine rock disposal area. A partial backfilling of the Eder pits in Years 14 and 15 using



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Figure 2-3
Final Carlota/Cactus
Pit Configuration

CAMBIOR USA CARLOTA COPPER COMPANY	
Date FEB 1994	CARLOTA/CACTUS
Drawing File GENERAL.DWG	Final Pit With Backfill
ALL MINING LINES ARE DRAWN AT BENCH CENTERLINE ELEVATION, 20 FEET ABOVE THE BENCH TOE. ALL BENCHES ARE LABELED WITH THE TOE ELEVATION.	
INDEPENDENT MINING CONSULTANTS, INC. TUCSON, ARIZONA	Reference Number 5904

mine rock from the last phase of mining in the Eder area, as well as mine rock from the Eder mine rock disposal area is proposed as part of project reclamation.

Table 2-4 presents the typical tonnage (by year) that would be transported to each of the mine rock disposal areas and the pit backfill. All of the disposal areas have been designed using a tonnage factor of 16.25 cubic feet per short ton and a face slope angle of repose of approximately 1.5 to 1, horizontal to vertical (H:V).

2.1.2.3 Materials Handling

Open-pit mining would be conducted with hydraulic shovels and with trucks to haul the ore to a crusher site and the mine rock to the disposal areas. The ore crushing facilities would include a gyratory primary crusher and a cone secondary crusher capable of handling the entire 7 million tons per year of ore. The gyratory crusher would be located adjacent to the pit with an overland conveyor to transport the primary-

crushed ore to a coarse-ore stockpile. The primary-crushed ores would be claimed from the coarse-ore stockpile and secondary crushed prior to placement on the heap. The ore from the Eder pits would be primary-crushed at a portable crushing facility temporarily located at the mouth of the Eder South pit and would be conveyed to the leach pad.

2.1.2.4 Pit Dewatering

Results of ground water baseline studies and testing indicate that dewatering of the Carlota/Cactus and the Eder pits may be required throughout the life of the mining operation. The ground water that exists in the pit areas tends to be fault- and fracture-controlled. Ground water quantities produced by the Carlota/Cactus pit are estimated to reach a maximum of approximately 150 gpm in the tenth year of mining (GWRC 1994). The maximum inflow to the Eder pits is predicted to be approximately 86 gpm (GWRC 1994). Dewatering wells and mine pit sumps would both be used to control ground water in the pits.

Table 2-4. Typical Mine Rock Disposal Area Tonnages by Year

Period	Mine Rock Destinations											
	Main		Cactus Southwest		Eder		Carlota/Cactus Pit Backfill		Eder North Pit Backfill		Eder South Pit Backfill	
	Ktons	Elevation	Ktons	Elevation	Ktons	Elevation	Ktons	Elevation	Ktons	Elevation	Ktons	Elevation
Preproduction	8,000	3,720										
Yr 4	17,000	3,840										
Yr 2	15,500	3,920	1,500	4,040								
Yr 3	12,100	3,960	5,200	4,120								
Yr 4	10,800	4,000	5,200	4,200								
Yr 5	17,000	4,000										
Yr 6	11,800	4,080	5,200	4,300								
Yr 7	7,500	4,080	9,400	4,300								
Yr 8	15,300	4,160			1,700	4,240						
Yr 9					500	4,240	18,500	3,480				
Yr 10							19,000	3,520				
Yr 11					1,000	4,240	11,000	3,560				
Yr 12					4,300	4,240	2,700	3,600				
Yr 13					1,500	4,240	400	3,600				
Yr 14					5,500	4,240					2,000	4,200
Yr 15					2,600	4,240			1,000	4,000	1,000	4,240
TOTAL	115,000		27,500		17,100		51,600		1,000		3,000	

Note: Elevation is the average disposal area elevation (ft-amsl) for a particular year.

2.1.2.5 Pinto Creek Diversion Channel

The present Pinto Creek drainage generally runs in a northerly direction through the middle of the Carlota/Cactus pit area. Because the ultimate pit would span Pinto Creek, a diversion channel would be required to convey both flood waters and sediments around the east and north side of the Cactus portion of the pit. The diversion channel would be designed to pass the peak discharge resulting from the 500-year, 1-hour thunderstorm event (Simons, Li and Associates [SLA] 1993). The thunderstorm precipitation for the 500-year, 1-hour thunderstorm is estimated at approximately 3.5 inches, and the peak flow rate is approximately 10,100 cfs.

The diversion channel would be approximately 5,250 feet long (*Figure 2-3*). The elevation of the channel inlet at the south end of the pit would be approximately 3,560 ft-amsl, and the elevation of the channel outfall would be approximately 3,480 ft-amsl. The slope of the diversion channel would be similar to that of the existing Pinto Creek drainage, averaging approximately 1.5 percent. Approximately 5,400 feet of Pinto Creek would be permanently displaced by the Carlota/Cactus pit.

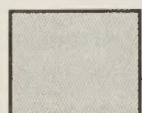
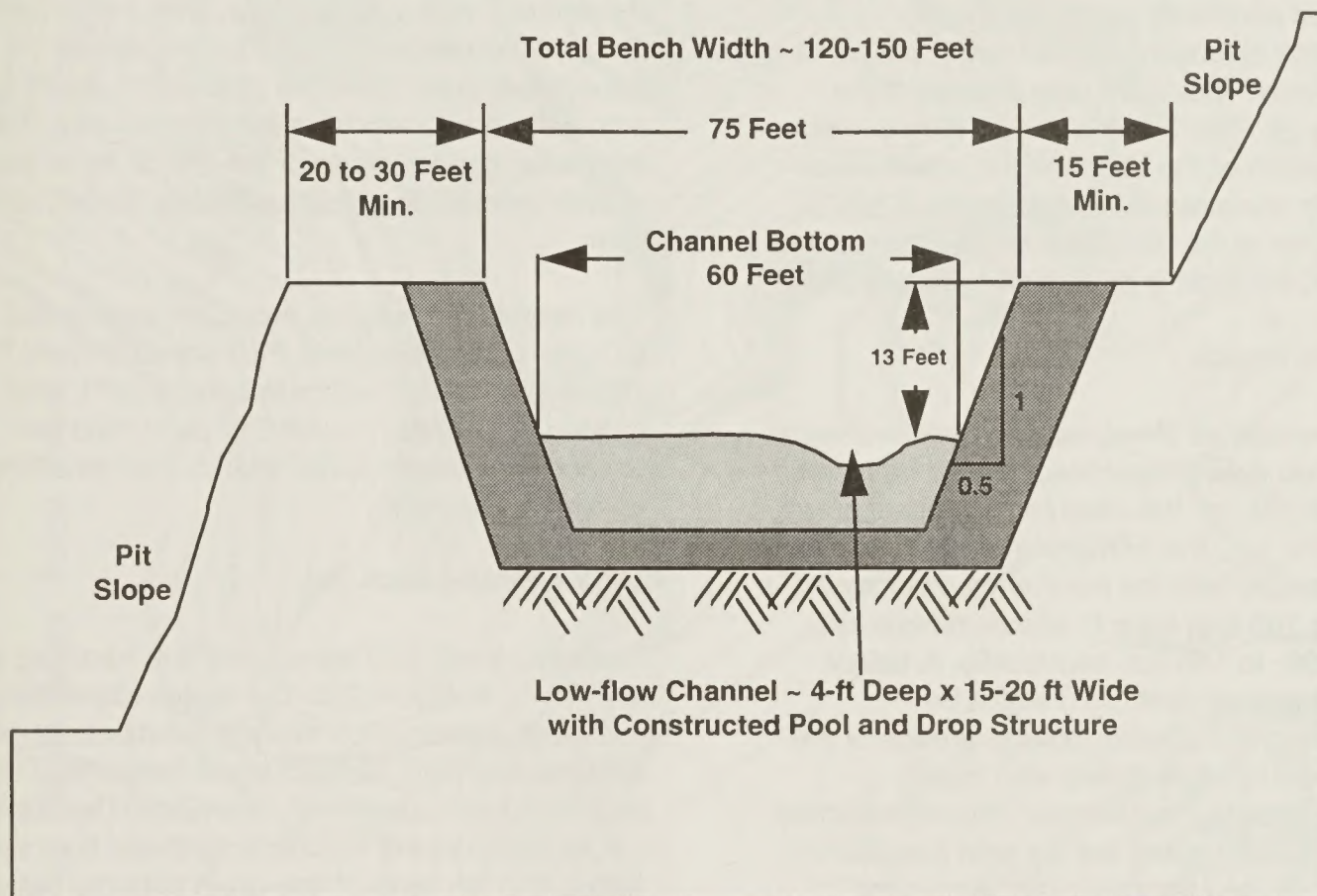
The diversion channel would be placed on a bench up to approximately 150-feet wide within the pit. The additional mine-rock volume required to establish this bench is included in the ultimate pit design, and the stripping required to clear this bench is included in the production schedule. The bench width would be conservative and would allow adequate room for the channel bottom, side slopes, and access and safety benches on either side of the channel. The channel itself would have a minimum bottom width of 60 feet and channel side slopes at 0.5H:1V.

A minor diversion channel alignment change from the Update to the Plan of Operations (Carlota 1993a) was proposed by Carlota (1994c) in response to a Forest Service concern regarding the stability of the portion of the diversion to be constructed in the Cactus Breccia overlying the low-angle Cactus fault. The Cactus Breccia in this portion of the Carlota/Cactus pit would be mined out, and the diversion channel would be realigned to place as much of the channel as possible in competent Pinal Schist bedrock to provide a permanent, stable base for the diversion. The Update to the Plan of

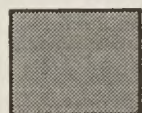
Operations (Carlota 1993a) indicated that the entire diversion channel would be lined with soil cement to afford scour and seepage protection. Carlota has modified this approach to provide a soil cement lining on the channel bottom and sides as necessary for additional scour and seepage protection since the channel realignment now places the permanent diversion in more competent bedrock (Carlota 1994c). The thickness of the lining would be a maximum of 4 feet on the channel bottom and 8 feet on the sides. A typical cross section of the proposed diversion channel is presented in *Figure 2-4*.

To meet the requirements of the CWA Section 404 permit, a plan has been developed to mitigate the impacts to waters of the U.S. caused by the mining of the Carlota/Cactus pit. The bottom of the proposed diversion channel would be over-excavated approximately 8 additional feet below the intended final channel bottom elevation. Alluvium would be excavated from the Pinto Creek stream bed and would be placed in this bottom portion of the diversion channel. Grade-control berms would be constructed across the channel at intervals in the alluvium to maintain the elevation of the alluvial ground water close to the surface. The aquatic resources would be re-established in the diversion by constructing riffle and pool structures in the alluvium. A low-flow channel would be constructed to concentrate low flows and support aquatic life and riparian vegetation. Riparian vegetation would be re-established to improve the aquatic habitat.

The alluvial aquifer would be intersected in the Carlota/Cactus pit; therefore, ground water stored and moving downstream in the alluvium would potentially drain into the pit, reducing flows in Pinto Creek. The potential for shallow ground water to drain from the alluvium into the pit would be minimized by constructing a cutoff wall through the section of alluvium upstream from the pit. The cutoff wall would be an impermeable barrier extending from the surface down through the alluvium and into the bedrock. The cutoff wall would be designed to prevent ground water from moving toward the pit wall and would encourage the alluvial flow to surface into the diversion channel to be routed around the pit. The need for a second cutoff wall constructed through the alluvium north of the Carlota/Cactus pit would be evaluated during the initial mining phases. This cutoff wall would be



Pinto Creek Alluvium Placed in Bottom of Channel (8-10 ft Deep)



Soil-cement Channel Lining (2-ft Thick on Bottom, 8-ft Wide on Sides)



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Figure 2-4

Pinto Creek Diversion Channel
Typical Cross Section

constructed, if necessary, to eliminate the potential for ground water discharge from the alluvium exposed in the north portion of the pit wall.

The proposed diversion channel is intended as the permanent alignment of Pinto Creek through the pit area after mining is concluded. Designs and modifications would be evaluated and implemented as necessary to ensure long-term postclosure functioning. The southeast portion of the pit, around which the diversion channel flows, would be backfilled with mine rock from later phases of the Carlota/Cactus pit. This material would fill in the pit below the elevation of the channel and would slope upward to a top elevation of approximately 3,600 ft-amsl. A plan view of the backfilled south-east portion of the Carlota/Cactus pit is presented in *Figure 2-3*.

2.1.2.6 On-Site Roads

On-site roads would be of two basic types: haul roads and mine service roads. Haul roads would be located within the open pits, on the mine rock disposal areas, and between the pits, the primary crusher, the mine rock disposal areas, and the mine shop. Haul roads would be 80 to 100 feet wide to accommodate two-way traffic for 90- to 150-ton haul trucks. A safety berm (approximately 6 feet high) would be constructed along the outside (downhill) edge of the road, as required by Mine Safety and Health Administration (MSHA) regulations. Drainage ditches would be constructed along the cut side (upgradient side/inside edge), and temporary or permanent culverts would be installed, as required. The haul roads would be surfaced with mine rock or gravel and designed for a maximum road speed of 30 miles per hour and a maximum road grade of 8 to 10 percent. Dust control would be accomplished by road watering.

Mine service roads would include both main access roads and minor service roads. Main access roads would be used for normal vehicle traffic to the mine and between mine facilities. They would be approximately 24 feet wide and would have smaller berms along the outside edge. They would be surfaced with gravel or left unsurfaced depending upon use and location. Chemical dust suppressants would be the primary means of dust control. Minor service roads, such as those that access wells and

monitoring points, would be built to a minimum standard dependent upon use and road location. Primary dust control would involve road watering as needed.

2.1.3 Heap-Leach Facilities

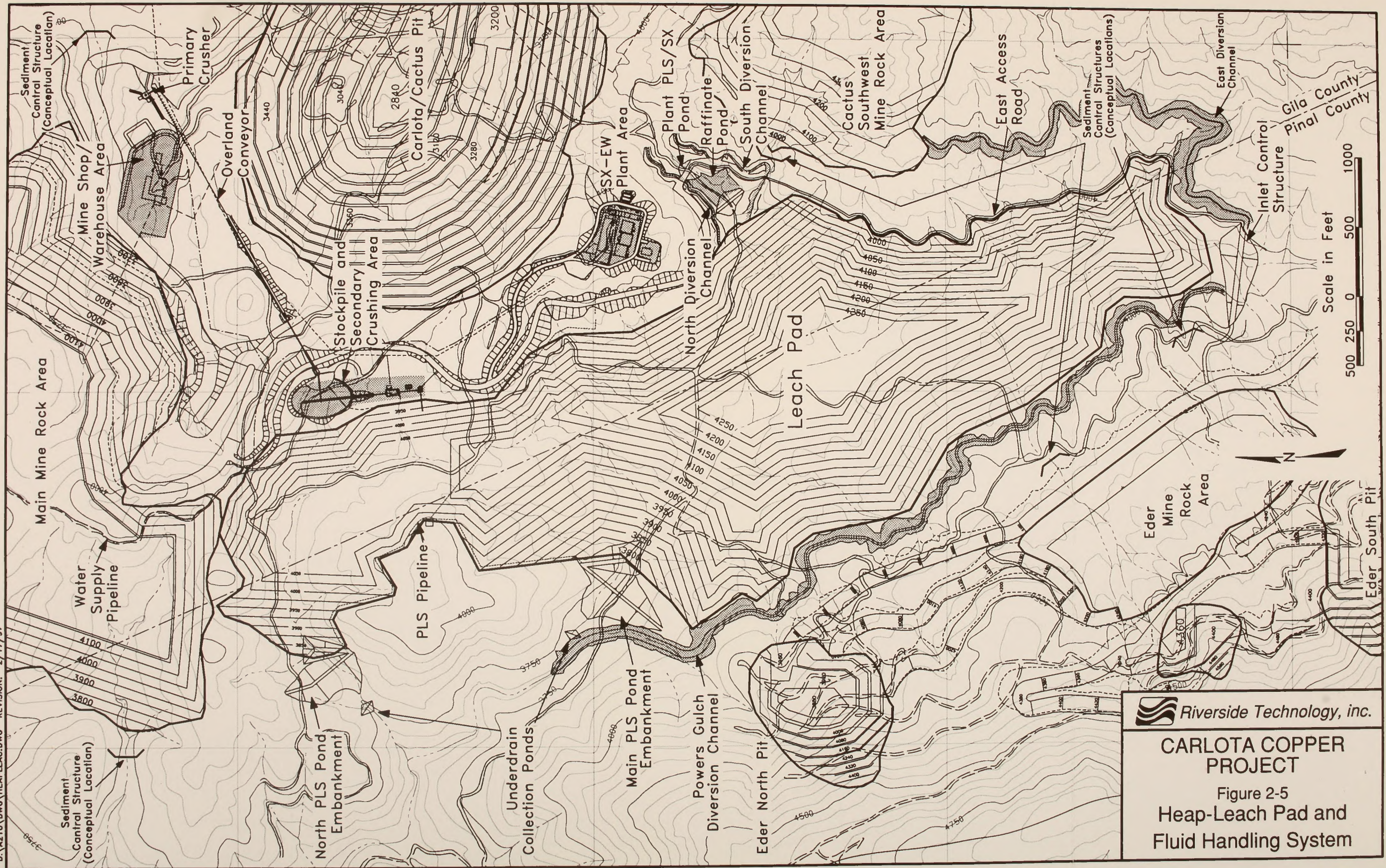
The design of the heap-leach facilities for the Carlota Copper Project is based on a nominal annual production of 7 million tons of ore, with a total reserve of at least 100 million tons and an ore density of 110 pounds per cubic foot. Ore production would be adjusted up or down from the nominal rate, depending on the copper grade of the ore, to try to maintain copper production at approximately 33,000 tons per year.

The heap-leach facilities include a segmented valley-fill leach pad with internal PLS ponds (Knight Piésold 1993b and 1995a), raffinate and plant PLS/SX ponds located adjacent to the SX/EW plant, and the associated Powers Gulch inlet control structure and diversion channels.

2.1.3.1 Heap-Leach Pad

The heap-leach pad layout and fluid handling system are shown in *Figure 2-5*. The layout identifies general pad configuration, PLS storage locations, and the raffinate and plant PLS/SX pond locations. The leach pad would use advanced valley-leach technology. Construction would include a synthetic liner system with a cushion layer of fine-grain material between the primary liner and the first lift of ore, with retention embankments at the downstream end of the pad, and internal storage of the PLS within the void spaces of the ore in the lower portion of the pad at the downstream area next to the embankments. The embankments would retain both the ore and the PLS and would be subject to both Forest Service and State of Arizona Dam Safety regulations.

The proposed leach pad would be generally located in Powers Gulch, directly west and over the ridge from the Carlota/Cactus pit, and would be divided into two sections. The main part of the pad would be located in Powers Gulch itself. A smaller part of the pad would be located in a small tributary drainage to the north of the main pad area. Ultimately, the two pad areas would be joined. The north pad area is not



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Figure 2-5
Heap-Leach Pad and
Fluid Handling System

only necessary to hold the total amount of ore, but is also useful because it would allow selective placement and leaching of ores that could require different leach rates or acid application rates compared to the majority of the ore. The main heap leach pad area would be constructed in two stages, and the north heap leach pad area would be constructed in a third stage. The first stage would have adequate storage capacity for the first 2 years of operation, and the second stage would require construction of the main heap leach pad area to the ultimate configuration. The third stage would start any time after the second stage and as late as Year 9 during operation (Knight Piésold 1996). Leaching on the north pad area would cease several years prior to leaching on the main pad.

Each of the two pad areas would require the construction of a retention embankment at the downstream side of the pad area. The embankment for the main pad would be located in Powers Gulch and would be approximately 110 feet high with a crest elevation of 3,830 ft-amsl (Knight Piésold 1997). The embankment for the north pad would be located in a small tributary drainage and would be approximately 107.5 feet high with a crest elevation of 3,866.5 ft-amsl (Knight Piésold 1997). Embankment slopes would be 2.5H:1V, and the crest width would be 20 feet. An additional PLS pond (the plant PLS/SX pond) would act as a surge pond for plant feed solution. This pond would be situated directly upstream of the raffinate pond. Embankment slopes would be 2.5H:1V, with a 40-foot crest width to allow vehicular traffic (Knight Piésold 1995a). The crest elevations of the plant PLS/SX pond and raffinate pond embankments would be 3,925 ft-amsl and 3,900.5 ft-amsl, respectively (Knight Piésold 1997). These embankments are designed as zoned earthfill/rockfill structures with internal drainage provisions. In addition, each of the embankment structures would be synthetically lined and would be fitted with a leachate collection and recovery system (LCRS), thereby providing for leak detection and minimizing the potential for saturating the embankment.

In general, the leach pad would slope from southeast to northwest, with a maximum constructed slope of approximately 50 percent on some of the natural side slopes. The steeper slope sections occurring in isolated areas would run perpendicular to the general pad slope and, in general, would

slope into the deepest heap areas. The pad would generally range from 150 to 300 feet high on all sides, except the face above the pad embankment, which would be approximately 450 feet high in the final configuration. The leach pad would be loaded in lifts from the bottom up, thereby allowing for maximum passive resistance during operation of the heap-leach pad. The passive wedge created by loading from the bottom up would provide resistance against slippage at the soil/liner interface.

The pad slope configuration would be composed of a series of short slopes, 25 to 40 feet high, with intermediate benches. The side slopes of the pad (i.e., any slope that does not terminate at the downstream embankment) would be configured at an overall composite slope of up to 2H:1V during construction and operation. The terminal slope above the pad embankments and along the Powers Gulch diversion channel on the west side of the pad would have a maximum composite slope of 2.5H:1V.

Perimeter berms would extend around the outside limit of the leach pad. These berms would typically be 12 feet wide at the crest and would be lined with 60-mil high-density polyethylene (HDPE) on the face toward the pad. The elevated east access road would act as the berm where it runs along the east side of the pad (Knight Piésold 1995a).

Existing shafts, adits, and underground workings encountered during construction within the pad area of the heap-leach facility would be decommissioned prior to the placement of overlying subgrade and liner systems. Shafts would be cleaned out to the greatest extent possible and then backfilled with rock to within 5 feet of the existing ground surface. The walls of the upper 5 feet of the shaft would be trimmed back at a slope of 1H:1V and backfilled with mass concrete. Adits or drifts exceeding 6 feet in diameter would be cleaned to their full extent and backfilled with mass rockfill to within 15 feet of the portal. The outer 15 feet would be backfilled with mass concrete, over which fine-grained subgrade soils would be placed. Adits or drifts less than 6 feet in diameter in areas where potential subsidence might occur would be cleaned to the greatest extent possible and backfilled with mass concrete using the tremie method to ensure the annulus is completely filled. Small adits or drifts (less

than 6 feet in diameter) in areas where subsidence is unlikely would be backfilled with rock fill to the extent possible, and mass concrete would be placed in the portal.

Should near-surface ground water occur beneath the pad, it would be collected and transmitted away from the heap via a central spine drain located in the topographic low of Powers Gulch; the central drain would be augmented by dedicated finger drains placed in the alluvium of the principal side drainages in the flatter valley bottom of Powers Gulch. These finger drains would collect alluvial ground water from the side drainages and transmit it to the central spine drain. The central spine drain would extend along the entire length of Powers Gulch within the pad basin. This underdrain system would minimize the potential for hydrostatic uplift in the heap-leach pad area and would facilitate the separation of ground water and process solutions. The central spine drain would consist of 8-inch-diameter, perforated, corrugated, polyethylene tubing (CPT) surrounded by drain gravel and non-woven geotextile; the spine drain would be placed in a trench approximately 3 feet square in section. The trench would be backfilled with in situ gravels. The finger drains would consist of 4-inch-diameter perforated CPT pipe surrounded by drain gravel and non-woven geotextile and placed in a trench approximately 1.5 feet square in section (Knight Piésold 1995a).

Water collected in the underdrain system would be transmitted under the main and north PLS pond embankments in Powers Gulch via concrete-encased HDPE pipe and would be discharged into collection ponds immediately downstream of each embankment. These underdrain collection ponds would be lined with an HDPE liner even though they would only contain near-surface ground water and would not be expected to contain any process water. The collection pond below the main PLS embankment could store approximately 775,000 gallons, including 3 feet of freeboard, or 1,100,000 gallons excluding freeboard. The collection pond below the north PLS pond embankment would be sized based on expected drainage from the north PLS pond area at the time of final engineering (construction of the north PLS pond area is anticipated to occur sometime between Years 2 and 9 of the leaching stage of the main PLS pond area).

Any drainage accumulating in the collection ponds would be automatically pumped back to the heap-leach pad for closed circuit containment (Carlota 1996a, Knight Piésold 1996f).

Random fill materials to construct embankments identified in the design would consist of waste materials from the mining operation. Drainage material exterior to the pad would also consist of waste material that would be screened to the appropriate design specification. Drainage material within the pad designated as overliner material would simply be use-specific crushed ore. These major construction materials exist in sufficient quantity on the site to complete the construction associated with the proposed design. If necessary, limited stockpiling of materials would be accomplished to meet the needs of future construction. In addition, mill tailings purchased from BHP Copper's Pinto Valley operation would be used as a cushion layer as described in the following section.

Pad Liner Systems

The heap-leach pad liner system would consist of a prepared subgrade of low-permeability, fine-grained material overlain by a synthetic geomembrane (*Figure 2-6*). The heap would be designed as a zero-discharge facility. Collection piping would be placed above the pad liner system to partially divide the pad into hydraulically separate cells to allow pregnant solution grade-building (preg-building) during operations. In the area of the pad adjacent to the embankments that would be used for solution storage of the typical operating volumes, a double liner and an internal LCRS would be constructed above the prepared subgrade. The LCRS would provide for the detection and recovery of solution should leakage occur through the primary liner. A network of drainage pipes would be positioned on the synthetic liner to provide drainage of leachate solutions along the graded flow paths.

The subsurface conditions in the proposed pad area would consist of various amounts of low-organic topsoil overlying bedrock or residual soil consisting of clays, silts, and sand/gravel. The residual soil would be predominantly silty material suitable for use as a leach pad subgrade. In many cases, these materials could be scarified in place and compacted to achieve

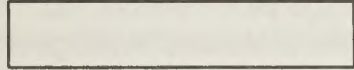
Double - Lined Pond Area Where Heap Height \geq 350 Feet



Crushed ore: primary- or secondary-crushed
with PLS collection pipes in the first lift



Fines barrier: 8-ounce non-woven geotextile



Cushion layer: 12 inches of mill tailings



Primary liner: 60-mil HDPE



LCRS zone: 12 inches of -0.5-inch crushed rock

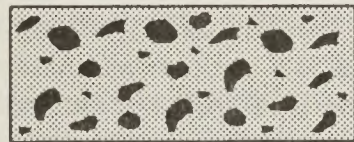


Secondary liner: 60-mil HDPE



12 inches of prepared natural subgrade

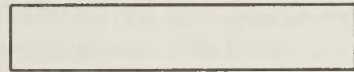
Single - Lined Pond Area Where Heap Height \geq 350 Feet



Crushed ore: primary- or secondary-crushed
with PLS collection pipes in the first lift



Fines barrier: 8-ounce non-woven geotextile



Cushion layer: 12 inches of mill tailings

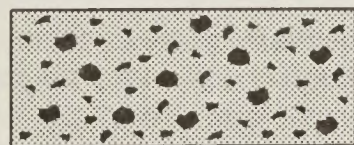


Primary liner: 60-mil HDPE



12 inches of prepared natural subgrade

Single - Lined Pond Area Where Heap Height \leq 350 Feet



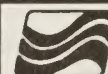
Crushed ore: secondary-crushed
(nominal -2-inch) ore



Primary liner: 60-mil HDPE



12 inches of prepared natural subgrade



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Figure 2-6

Leach Pad Liner System

12 inches of a prepared subgrade of low-permeability material.

In areas where in situ materials are not suitable for the subgrade, fine-grained borrow material would be available from within the pad area. Where in situ soils are too coarse, selective mixing of the borrow material with native soils could produce suitable materials. Where bedrock is encountered, borrow material would constitute the entire thickness of subgrade liner material.

A geotechnical investigation conducted in the vicinity of the heap-leach facility indicates that 100,000 to 300,000 cubic yards of suitable subgrade material may occur in one borrow area. Borrow sources for an additional 200,000 to 300,000 cubic yards of suitable subgrade may exist through recovery of deeper soil materials identified during baseline soil surveys within the proposed pad area. Currently, the requirements for fine-grained media to construct 12 inches of low-permeability prepared subgrade amount to approximately 435,000 cubic yards. It is apparent from the investigation that much of the pad's subgrade could be scarified and recompacted in place to produce part of the prepared subgrade required in the design. With additional borrow sources as described, it appears that sufficient material does exist to place 12 inches of suitable subgrade over the entire pad area. A description of "suitable material" would be included in the specifications of the subgrade. These specifications would include acceptable ranges of grain size distribution and plasticity, and maximum saturated hydraulic conductivity at or above 95 percent optimum moisture density. This design would be based, in part, on further testing of the subgrade material. The testing would involve sampling and characterizing the subgrade of the pad in several locations (Carlota 1996b).

The primary liner system for the proposed heap-leach pad would consist of a 60-mil HDPE liner (*Figure 2-6*). The effective permeability of the HDPE liner would be on the order of 1×10^{-11} centimeters per second. In areas of heavy traffic or where the heap would be higher than 350 feet, a 12-inch protective layer consisting of mill tailings purchased from BHP Copper's Pinto Valley operation would be placed on the 60-mil HDPE primary liner. This cushion layer would protect the primary liner from the loads applied as a result of heap height and/or traffic. An 8-ounce

non-woven geotextile would be placed on top of the protective layer such that fines would not migrate into the crushed ore placed on the heap (Knight Piésold 1995a).

The solution collection system within the pad would consist of minus 6-inch or minus 2-inch crushed ore with an internal drainage pipe network that would be placed directly over the protective layer/geotextile and the primary liner. The overliner material would be placed to enhance drainage immediately above the liner system (Knight Piésold 1995a). The internal-collection pipework would include primary, secondary, and tertiary piping of dedicated sizes. Typically, primary collection header pipes dewatering primary cells would be 12-inch-diameter perforated CPT and 12-inch HDPE pipes. Primary header pipes would be connected to secondary 8-, 6-, and 4-inch perforated CPT, as appropriate, depending on the hydraulic capacity requirement of a particular location within the pad. Testing of the proposed collection pipe under loading projected for the Carlota heap-leach pad has shown that the pipe would perform within acceptable limits. A letter from the pipe producer sanctioning the pipe's use in the Carlota heap-leach pad would be provided to the Forest Service prior to heap construction (Carlota 1996b).

The internal pipe network associated with the solution collection system would be installed early during the placement of the overliner or heap material to provide solution drainage. The overliner material would then act as a drainage layer, with the pipe network providing a preferential flow path for dewatering. The solution collection system would be designed to minimize the height of the solution (hydraulic head) above the synthetic liner. Minimizing hydraulic head would minimize the hydraulic pressure on the liner and reduce the potential for downward seepage through the liner system. Further, the high-permeability overliner and drainage network would facilitate rapid transmission and collection of leach solutions. The liner would extend to and be keyed into the leach pad perimeter berms.

Installation of the pipe network within the overliner would be accomplished by hand or other careful method to minimize the potential for damage to the underlying liner system. Equipment traffic on the overliner would be limited to minimize potential damage to the internal piping. A construction quality

assurance/quality control plan is included as part of the heap-leach design (Knight Piésold 1995a). This plan would help to ensure proper construction and testing of the facility. The impact of short-term construction loadings on the integrity of the geomembrane would be evaluated by constructing a test pad geomembrane liner system 30 feet by 100 feet. After construction, the test pad would be dismantled so that any potential damage to the geomembrane could be evaluated. This would allow for modifications, if necessary, to the liner system construction procedures.

Fluid Handling System

Solutions collected within the heap-leach pad would be transmitted to the internal PLS ponds via the collection pipes located at the base of the heaped ore. Process solutions from the PLS ponds would be recycled to the plant for processing and reuse.

2.1.3.2 Process Solution Ponds

The proposed design includes two PLS ponds located within the main and north heap-leach pad areas, a plant PLS/SX pond, and a raffinate pond. The ponds have been designed specifically to manage process and storm solutions. The heap-leach solutions would be collected within the void spaces of the heap material itself at the downstream end of the pad. One PLS pond would be located in Powers Gulch and would service the main leach pad area. A second PLS pond would be located in a tributary drainage and would service the north pad area. The PLS ponds were positioned in the design to make efficient use of the natural topography and to maximize pad storage. The raffinate pond would be located downgradient from the plant site to provide gravity flow for surface runoff and to provide spill containment from process plant upsets. In addition, the raffinate pond would be located upgradient of the leach pad to allow the operator an opportunity to contain barren solution within the leach pad if the raffinate pond would overtop. The plant PLS/SX pond would be located immediately upstream of the raffinate pond. The locations of the embankments that would retain the two PLS ponds within the pad, the plant PLS/SX pond, and the raffinate pond are shown in *Figure 2-5*.

Pond Liner Systems

The raffinate pond, the plant PLS/SX pond, and the two PLS ponds located within the leach pad have been designed as double-lined facilities with an LCRS. The liner system for the main and north PLS ponds (*Figure 2-6*) would consist of a 12-inch prepared subgrade overlain by a 60-mil HDPE secondary liner. The primary liner would be a 60-mil HDPE membrane, which would be separated from the secondary liner by 12 inches of minus 0.5-inch crushed rock to form an LCRS. The 60-mil HDPE primary liner would cover the entire leach-pad area. The 60-mil HDPE secondary liner and LCRS have been designed to underlie the area where operating solutions would normally pond. This system design is based on the dewatering capability and the minimal time that stormwater may need to be contained.

The double-lined system for the raffinate and plant PLS/SX ponds would consist of a 12-inch prepared subgrade overlain by a 40-mil HDPE secondary liner. The primary liner would be a 60-mil HDPE membrane, which would be separated from the secondary liner by an HDPE drainage net (Geonet) to form an LCRS. The LCRS would be used to detect, collect, and remove solution if leaks develop in the primary liner. The slope of the downstream face of the plant PLS/SX pond would accommodate the extension of the liner system for the raffinate pond onto the face of the plant PLS/SX pond.

Details of the LCRS are presented in the Knight Piésold and Company heap-leach pad design document (1995a). Any solution captured between the liners would drain to the low point in the pads, along either the natural drainage of Powers Gulch or the drainage in the north pad, and would be collected in the LCRS sumps located at the upstream toe of the leach pad embankments. The sumps at the main embankment and at the north embankment would have containment capacities of approximately 10,000 and 7,900 gallons, respectively. The sumps would be connected to the surface by 10-inch diameter HDPE pipes that would run up the face of the embankments. These pipes would be used to inspect and recover any solutions collected in the sumps. If solutions are detected in the sumps, a pump would be installed in

the 10-inch inspection pipe, and the solutions would be pumped out, analyzed, and used in the process.

Pond Capacities

The entire heap-leach facility, including the heap leach and PLS embankments, the raffinate and plant PLS/SX ponds, the diversion channels and inlet control structure (subsequently described in Section 2.1.3.3) would operate in conjunction with one another to safely accommodate the operational volumes plus the peak flows and volumes resulting from one-half the probable maximum flood (1/2 PMF). All stormwater from an event of this magnitude that comes in contact with process water would be totally contained behind the main and north heap-leach pad embankments; no discharge of process solutions would occur from the facility. Based upon an average ore porosity of 34.5 percent for the main PLS pond and 39.3 percent for the north PLS pond, approximately 190.2 million gallons of solution (170.2 million gallons excluding 3 feet of freeboard) could be stored behind the main pad embankment, and 58.4 million gallons (52 million gallons excluding 3 feet of freeboard) could be stored behind the north pad embankment (Knight Piésold 1995e, 1996f, and 1997).

The plant PLS/SX pond is designed to contain a maximum operational volume of 1.59 million gallons with the capacity to hold an additional 1.59 million gallons of stormwater. Therefore, the total pond capacity with 3 feet of remaining freeboard would be 2.31 million gallons, and the total capacity at the crest of the embankment would be 3.18 million gallons (Knight Piésold 1997).

The raffinate pond is designed to contain a maximum operational volume of 1.79 million gallons with the capacity to hold an additional 2.75 million gallons of stormwater. Therefore, the total pond capacity with 3 feet of remaining freeboard would be 3.46 million gallons, and the total capacity at the crest of the embankment would be 4.54 million gallons (Knight Piésold 1997). As designed, the plant PLS/SX and raffinate ponds would contain the largest estimated combined volume of stormwater (resulting from the 72-hour 1/2 probable maximum precipitation [PMP]) and antecedent storage with 3 feet of remaining freeboard (Knight Piésold 1996i).

As a protective measure, limestone would be placed on the downstream face of the main and north PLS pond embankment random fill zones, along the downstream face of the embankment foundation excavations, and downstream of the underdrain collection ponds (Knight Piésold 1995a). In the unlikely event that any process water would escape from the heap-leach facility, the limestone would act as a buffer to neutralize the water quality.

Solution Recovery Systems

The solution recovery systems for the main and north PLS ponds would be similar. Process solutions contained in the main PLS pond would be pumped from the pond via four 48-inch-diameter HDPE sumps located within reclaim structures placed slightly upstream of the pond embankment. Each of the four pumps would be rated at a minimum of 3,000 gallons per minute. Process solutions in the north PLS pond would be pumped from two sumps configured similarly to those for the main PLS pond (Knight Piésold 1995a). Each of these two pumps would also be rated at a minimum of 3,000 gallons per minute. Backup pumps would also be included at both the main and north PLS ponds (Knight Piésold 1995a). Diesel-powered backup electrical generators would be provided to supply emergency power to the pumps.

The plant PLS/SX pond and the raffinate pond would incorporate two 14-inch-diameter, concrete-encased HDPE reclaim outlet pipes leading from sumps at the upstream toes of the embankments (under the pond embankments) to a pump station located at the downstream toe of the raffinate pond. The pump station for these ponds would consist of five horizontal centripetal pumps, each rated at a minimum of 3,300 gallons per minute (Knight Piésold 1996i). Two pumps would operate for each pond at all times. Solutions from the leach-pad PLS ponds would be pumped to either the processing plant (via the plant PLS/SX pond) or back to the heap for preg-building, and solutions from the raffinate pond would be applied to the heap (Knight Piésold 1995a).

The fifth horizontal centripetal pump would be included as a backup to the four primary horizontal centripetal pumps on the plant PLS/SX and raffinate ponds. The backup pump would be available as

necessary to dewater significant precipitation events or excess pond solutions or to provide pump redundancy in the event of a mechanical failure (Knight Piésold 1995a, 1996h). In both cases (PLS/SX or raffinate ponds), excess solutions would be pumped to and sprayed on the heap to evaporate excess solutions. Standby diesel power generation would be provided to supply emergency backup power to the pumps.

2.1.3.3 Powers Gulch Inlet Control Structure and Diversion Channel

An inlet control structure would be constructed in Powers Gulch upstream of the proposed heap-leach pad (*Figure 2-7*). A storm water diversion ditch along the southeast side of the heap (the east diversion channel) would drain to the inlet control structure at the south end of the heap (Knight Piésold 1995a). This inlet control structure would route flows downstream to the main Powers Gulch diversion channel in a controlled manner; it would **not** be designed to retain and supply water for project operation; therefore, a water right would not be required. The area immediately upstream from the inlet control structure would be backfilled to the elevation of the outlet pipe. The outlet pipe would route flows via gravity to the Powers Gulch diversion channel. A cutoff wall would be constructed at the base of the inlet control structure embankment to intercept alluvial flow in Powers Gulch above the leach pad and divert it into the diversion channel.

The function of the inlet control structure would be to meter stormwater runoff into the Powers Gulch diversion channel by routing the storm events through a controlled outlet, thereby minimizing the required width of the diversion channel during project operation.

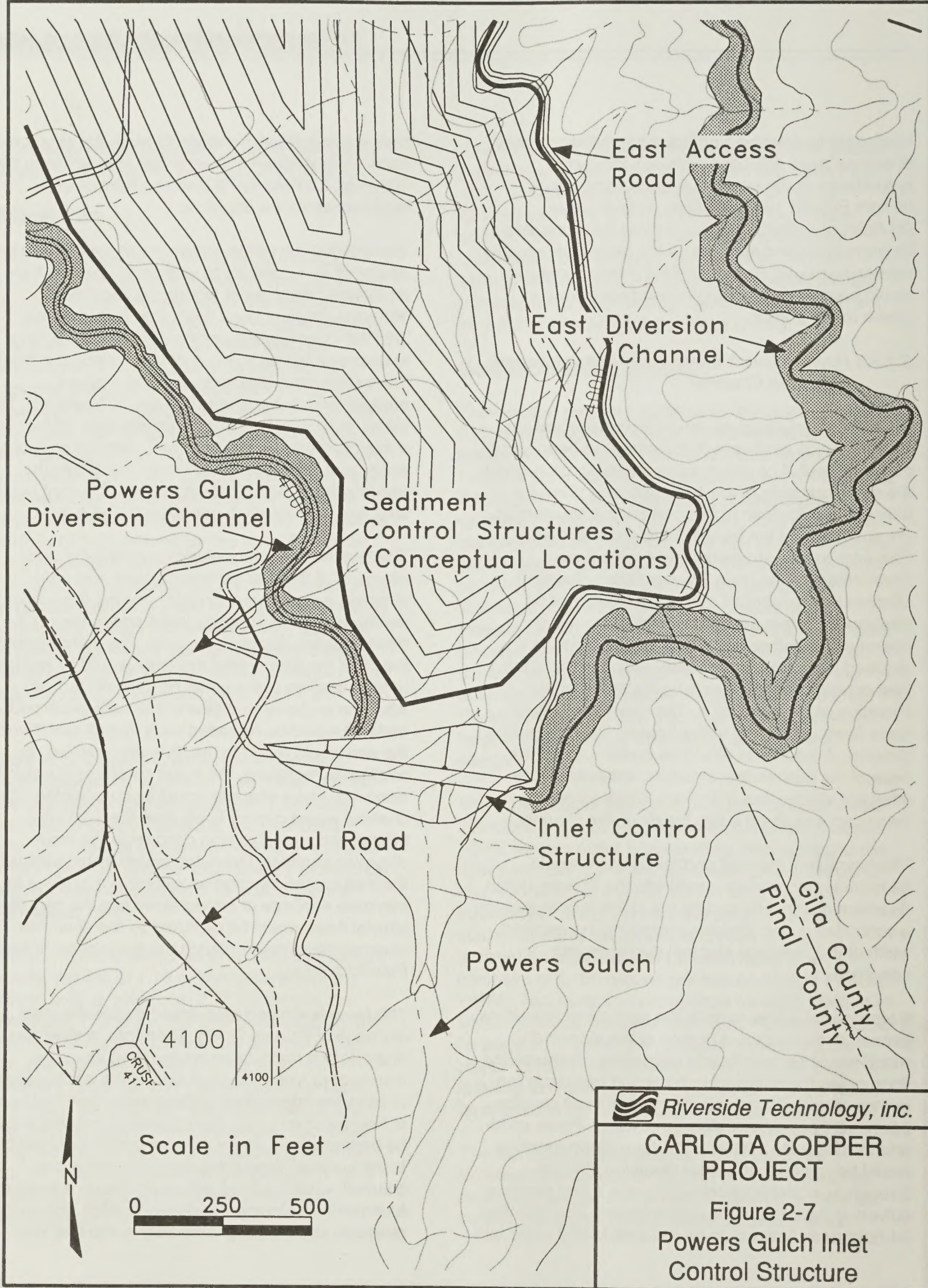
If stormwater inflow rates to the inlet control structure exceed outflow rates, a portion of the stormwater runoff would be temporarily detained to decrease the flood peak; the detained water would free-drain (no pumps required) from the structure without causing permanent ponding or storage of water. Flows up to and including the 100-year, 24-hour storm event would be routed to the main diversion channel through an outlet pipe consisting of a 7-foot diameter culvert at the base of the embankment. The 100-year, 24-hour peak flow would be reduced to 910 cubic feet


per second (cfs) as it passes through the structure; up to approximately 100 acre-feet of runoff from the 100-year, 24-hour event could be temporarily detained within the structure.

The entire width of the embankment crest would be designed as necessary to withstand overflow from an extreme flood event (floods greater than the 100-year, 24-hour peak flow). Any flow up to the 1/2 PMF over the embankment of the inlet control structure would be safely contained within the heap. The inlet control structure would be a zoned earthfill/rockfill structure with 3 feet of freeboard. The maximum height would be approximately 78 feet, with a minimum crest width of 40 feet. Erosion protection, seals, and drains would be incorporated into the construction (Knight Piésold 1995a). The inlet control structure would disturb approximately 8 acres.

The closure scenario includes lowering the crest elevation of the inlet control structure and constructing a diversion channel to convey flows from the southeast side of the heap leach pad to the main Powers Gulch diversion channel. The embankment height of the inlet control structure would be reduced to the elevation of the outlet pipe (3,992 ft-amsl). Also, the embankment fill and the heap-leach pad material would be regraded such that all runoff from the pad would report to the diversion channel. In addition to regrading, the outlet control pipe would be removed, and a channel would be constructed. The channel would convey flows from the southeast hillside and east diversion channel to the main diversion channel. The cutoff trench associated with the inlet control structure would remain in place to minimize seepage of alluvial flows into the pad; the alluvial flows would be captured by the diversion channel rather than entering the spine drain (Knight Piésold 1995a).

The heap-leach pad area would overlie the main drainage of Powers Gulch. Therefore, a diversion channel (the main diversion channel) would be constructed along the west side of the leach pad area to carry the intermittent surface water flow that occurs in Powers Gulch. The main diversion channel would be bedrock-lined where suitable bedrock occurs close to the surface. Where this does not occur, the channel would be lined with shotcrete on a prepared foundation. A stormwater diversion ditch (the east diversion channel) approximately 4,400 feet long



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Figure 2-7
Powers Gulch Inlet
Control Structure

would be constructed around the southeast side of the facility to convey undisturbed surface runoff into the main Powers Gulch diversion via the inlet control structure. The east diversion channel would be reconfigured at closure to be a permanent structure capable of withstanding and passing a prescribed storm event.

The leach pad would be located near the top of the drainage basin of Powers Gulch; the contributory watershed above the main pad embankment is approximately 2.2 square miles. The contributory area above the proposed diversion is approximately 0.6 square mile. The main diversion channel would be approximately 7,500 feet long (*Figure 2-5*). The elevation of the diversion channel inlet would be approximately 4,000 ft-amsl; the diversion outfall elevation would be approximately 3,700 ft-amsl. The upper portion of the diversion channel would be approximately 5,450 feet long with gradients ranging from approximately 1.2 to 2.9 percent. The lower portion of the diversion channel would consist of a 1,220-foot long flume drop to convey the flow back into Powers Gulch below the leach pad. The upper 690 feet of the flume drop would have an average gradient of approximately 19 percent; the middle 380 feet of the flume drop would have an average gradient of approximately 15 percent; and the lower 150 feet of the flume drop would have an average gradient of approximately 3 percent. Channel transitions would be constructed at both ends of the flume drop to dissipate energy and reduce the potential for scouring in Powers Gulch. Approximately 6,700 feet of the natural Powers Gulch channel, with an average gradient of 4.1 percent, would be permanently displaced by the heap-leach facilities.

The Powers Gulch diversion channel would be designed to operate in conjunction with the inlet control structure and the heap-leach pad, with sufficient cross sectional area and carrying capacity to pass the attenuated peak flow from a 6-hour 1/2 PMF. Erosion protection in the form of reinforced shotcrete would be provided where necessary to stabilize the transitions. The recommended depth for the diversion channel (or height of the stabilized banks) would be determined as a function of the flow depth, with additional consideration for surface waves and the possible accretion of a sediment layer. Free-board of 1 foot would be added to account for hydraulic uncertainties. Based on preliminary esti-

mates, the typical channel cross section would be trapezoidal shaped, with a bottom width ranging from 15 to 50 feet, 1.5H:1V side slopes, and depths of 3.2 to 10.2 feet (*Figure 2-8*). A low-flow channel geometry would be provided above the flume drop. In addition, stabilized secondary channel entrances would be constructed along the main diversion channel to accept lateral inflows from adjoining ephemeral drainages.

The peak flows and runoff volumes conveyed to the main Powers Gulch diversion channel would increase at mine closure as a result of removing the inlet control structure. To ensure that the increased flow would pass safely through the diversion, the heap-leach pad would be regraded and armored with waste rock adjacent to the main diversion channel, thus increasing the channel cross-sectional area and flow carrying capacity to be adequate for a postclosure event as prescribed by regulatory agencies (Knight Piésold 1995). The reshaped diversion channel would convey large flood events without impacting the stability of the heap or allowing flood waters to infiltrate the leach pad.

2.1.4 Ore Processing Operations

The designs of the ore processing facilities for the Carlota Copper Project were based on the following criteria:

- 100 million tons of ore for the mine life
- Annual copper production of 33,000 tons

The design includes the standard oxide copper processing steps of acid-leaching followed by SX/EW. The design also includes crushing facilities, ore transport systems, ore stacking systems, and the required utility and reagent systems. The ore, process facilities are scheduled to be completed during the initial construction phase. A block flow diagram of the processing circuits is presented in *Figure 2-9*.

2.1.4.1 Crushing, Conveying, and Stacking

All ore mined from the Carlota/Cactus pit would be hauled to the permanent primary crusher site located just north of the pit. From the primary crusher, the coarse ore would be transported approximately 3,100 feet by overland conveyors to a segmented coarse-

ore stockpile located on the ridge northwest of the pit and adjacent to the leach pad. Ore from this stockpile would be reclaimed and conveyed to the secondary crusher and pretreatment area. Ore would then go to the leach pad conveyor and stacking system, or to a loading facility for truck stacking.

A contract crushing operation would be implemented toward the end of the project to primary-crush ore when the Eder pits are being mined. The crushed ore would either be loaded back into haul trucks and truck-dumped on the leach pad or conveyed to the leach pad.

The ore bin at the primary crusher would receive run-of-mine ore from the Carlota/Cactus pit dumped directly from haul trucks. The bin would be equipped with a pedestal-mounted hydraulic rock breaker to reduce oversize material. Provisions have also been made in the layout of the mine shop facilities to allow for a small run-of-mine ore stockpile to be built from the east end of the mine facilities pad down to the primary crusher site. Ore from this stockpile would be fed into the ore bin using a front-end loader.

From the bin, ore would pass through a gyratory primary crusher and would be crushed to a nominal 8-inch size. Crushed ore would be reclaimed from the bin underneath the gyratory crusher by a belt feeder discharging to the overland conveyor for delivery to the stockpile. The primary-crushed ore would be stored in an open stockpile, which would provide approximately 1 day of live capacity.

Primary-crushed ore would be reclaimed from the stockpile by three variable-speed belt feeders and conveyed to the secondary-crushing circuit. Minus 8-inch ore would be reclaimed from the stockpile, delivered to the secondary-crushing tower, and discharged onto a double deck screen. Oversize material would flow into the secondary crusher and would be reduced to minus 2-inch diameter. Screened undersize material would flow directly to the secondary-crusher discharge conveyor for delivery to the leach pad. A baghouse would be installed to control dust emissions from the screen and secondary crusher systems (Carlota 1994d).

Crushed ore would be transferred from the secondary crusher to the active level of the heap over a series of

fixed and/or portable conveyors. From this point, the current heap lift would be built either by using a radial-arm conveyor stacker or loading crushed ore into mine haul trucks and truck-dumping the current lift. Ore would be stacked on the leach pad in 15- to 40-foot-high lifts.

Preconditioning the ore with a strong sulfuric-acid solution, a common practice in copper heap-leach operations, may not be required for all of the Carlota ore types. If a preconditioning solution is used, it would be sprayed into the ore on a conveyor belt after secondary crushing. The moisture content of the ore after adding the preconditioning solution would be approximately 7 percent.

2.1.4.2 Leaching

Ore on the pad would be leached with raffinate pumped from the raffinate pond to the heap by two horizontal centripetal pumps located on the downstream side of the pond embankment. Raffinate would be reclaimed via a sump connected to HDPE pipe constructed in the embankment. Raffinate would be pumped to the heap and distributed by a system of solution emitters (drip lines), impulse sprinklers, and/or wobbler sprinklers. Raffinate would be distributed by solution emitters unless the mine experiences surplus water conditions and is actively trying to reduce available water by evaporation. The solution emitters (drip lines) use no sprays or sprinklers. Solution is applied through more closely spaced, similar-diameter (1 inch or less) distribution lines, with the solution dripping or running out of small emitter devices that are installed in-line in the distribution lines. The impulse sprinkler is an industrial version of the common residential lawn sprinkler, with an oscillating arm that breaks up the spray of solution, attempting to cover the area close to the sprinkler head and out to the full radius of the pad. The wobbler sprinkler is a very simple design with fewer moving parts than the impulse sprinkler. The only moving part is a cone-shaped distributor head that is allowed to oscillate or wobble above the fixed spray of solution, which sprays upward out of the sprinkler head. The shape of the wobbling head distributes the leach solution in a random pattern around the spray head.

The configuration of the leach pad would require two separate embankments for PLS retention, and each

embankment would be equipped with a pumping system. PLS solution would be pumped to the SX circuit by four submersible pumps and two horizontal-centrifugal pumps. The two submersible pumps would be mounted inside an HDPE pipe anchored to the upstream face of the pad embankment. Reclaimed PLS would be delivered to a sump for pumping to the SX circuit by one of the two horizontal centrifugal pumps.

The piping for the submersible and horizontal centripetal pumps would be designed to allow recirculation of all or part of the PLS to the heap. Recirculation would allow for better PLS grade and solution management.

2.1.4.3 Solvent Extraction

PLS would be pumped from the plant PLS/SX pond to the first extraction stage of the SX plant. The single-train SX plant would consist of two extraction stages in series and one stripping stage. Mixer-settlers would be used with two mixing boxes in series on each extraction and stripping stage. The PLS would contact stripped organic in countercurrent flow to produce barren raffinate and copper-loaded organic. The raffinate would be delivered to the raffinate pond, where it would be pumped to the heap. Loaded organic would flow by gravity to a loaded organic surge tank provided with an internal baffle system to assist in removing entrained aqueous. The copper-loaded organic would then be contacted with spent electrolyte in the stripping stage to transfer the copper into the aqueous phase, producing strong electrolyte for EW. Strong electrolyte from the strip stage would flow through a pair of column flotation units in series and into a surge tank for removing entrained organic. The strong electrolyte would then be pumped to the tank house. A general arrangement of the SX circuit is presented in *Figure 2-10*.

2.1.4.4 Electrowinning

The EW circuit would have a design capacity of 33,000 tons of copper per year, based on the maximum projected annual production. In a tank house adjacent to the SX plant, EW of copper from the strong electrolyte would be carried out. The electrolyte would pass into a recirculation tank, where it would enrich circulating electrolyte passing to the

cells. In the cells, electrolysis would deposit copper on the cathodes. The tank house design would be a total production stripping (TPS) operation using permanent stainless steel cathode blanks.

Deposited cathodes would be harvested from the cells on a 7-day cycle by an overhead bridge crane, which would place them on a receiving conveyor at the cathode washing and stripping machine. This conveyor would advance the cathodes through a wash chamber, where high pressure sprays would thoroughly drench the cathode deposits with hot water. Cathodes would be delivered to a flexing station that would free the deposit and would allow the following knife station to easily strip the cathode plate. The cathode sides would fall onto a collector roller conveyor and would accumulate in stacks. Stripped permanent cathodes would be transported and placed on a discharge accumulating conveyor. This conveyor would advance the cathodes over an elevating wax bath, which would rewire the bottom edges. This wax would prevent deposition of copper around the cathode and would aid stripping. The stacks of cathode sides would be weighed, sampled, and banded for shipment using an automated system.

Strong electrolyte would pass through a heat exchanger to heat the incoming strong electrolyte prior to circulating the solution through the EW cells. Acid and water make-up would be added to the spent electrolyte before its return to solvent extraction. Cobalt sulfate (as an anode corrosion reduction reagent) and Guartec (to smooth the cathode surface) would be added as solutions to the recirculation tank. A bleed would be removed from the spent electrolyte stream to control the concentration of iron and other impurities. This bleed would be added to the feed at the first extraction stage of the SX plant.

Generation of acid mist at the top of the cells by the evolution of anodic oxygen would be controlled at the source by layers of polypropylene beads. This would be supplemented by a passive convective ventilation system. Air flow from outside the building would be directed across the cell tops and exhausted from the building through side vents located approximately 27.5 feet above the ground level near the ridge of the tank house roof. A general arrangement of the EW circuit is presented in *Figure 2-11*.

2.1.4.5 Utilities and Reagents

Compressed air for the facility would be provided by two compressors. Normally only the larger of these units would be in operation and would supply 100 pounds per square inch (psi) air to a receiver for use as plant air. Some of the air would be diverted into an instrument air receiver, from which it would be used for instrumentation purposes throughout the plant. During compressor maintenance or failure, the second compressor would operate. This unit would supply only enough air for instrumentation and valve actuator requirements. Reagents required for ore processing operations and the operational considerations for these substances are addressed in Section 3.14, Hazardous Materials.

2.1.5 Project Support and Ancillary Facilities

2.1.5.1 Mine Facilities Area

The mine facilities and warehouse area would be located on a leveled pad, approximately 750 feet by 350 feet, directly north of the Carlota/Cactus pit and to the west of the primary crushing facility. The facility would be accessible from the main haul road that runs to the north of the pit past the primary crusher site and up to the Main mine rock disposal area. The building would be a pre-engineered steel structure and would accommodate the following general functions:

- Mine Equipment Maintenance
- Mine and Plant Parts Warehouse
- Additional Process Plant Warehouse Space
- Mine Operations and Engineering Offices
- Field Storage and Distribution
- Equipment Ready Line

A schematic of the mine facilities and warehouse area is presented in *Figure 2-12*.

The mine equipment maintenance shop would service all equipment in the mine fleet, including haul trucks as large as 150-tons, 13-cubic-yard front-end loaders, and tracked and rubber-tire dozers and drills. The shop would include four major equipment bays arranged in two dual drive-through bays, an outside washdown bay, small vehicle repair bays, and associated lubricant and parts storage areas.

The mine facilities building would provide office space for the mine operations and maintenance supervisors. Other facilities to be provided in the building would include a lunch/conference room, a training room, and a first-aid room.

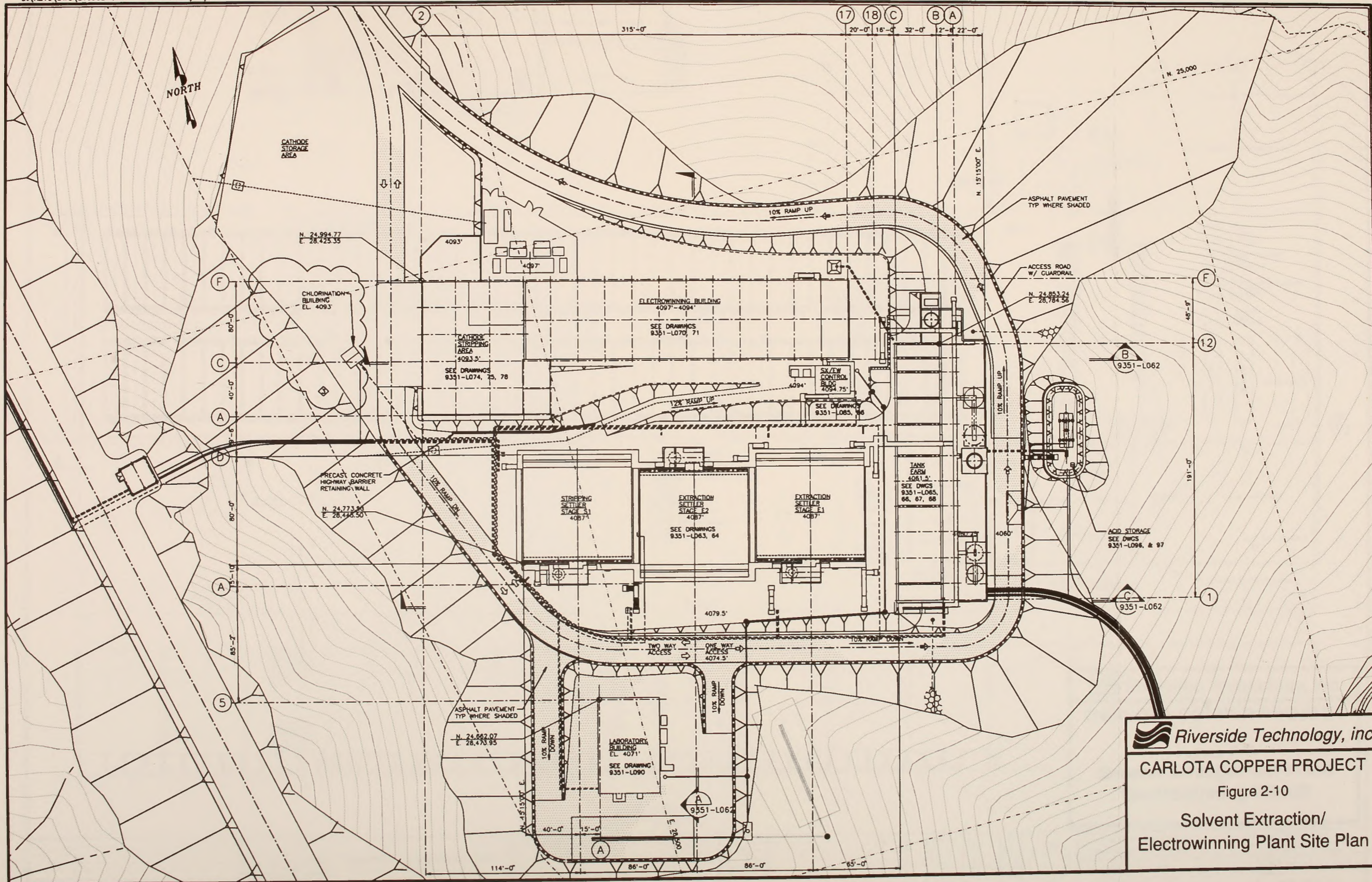
Ample area would be provided for mine equipment access, through clearance, small vehicle parking space, and a mine equipment ready line. With the mine facilities area being located directly west of the primary crusher, the eastern edge of the leveled pad could also be used as the dumping point for a coarse-ore stockpile to the crusher.

2.1.5.2 Solvent Extraction - Electrowinning Plant and Process Areas

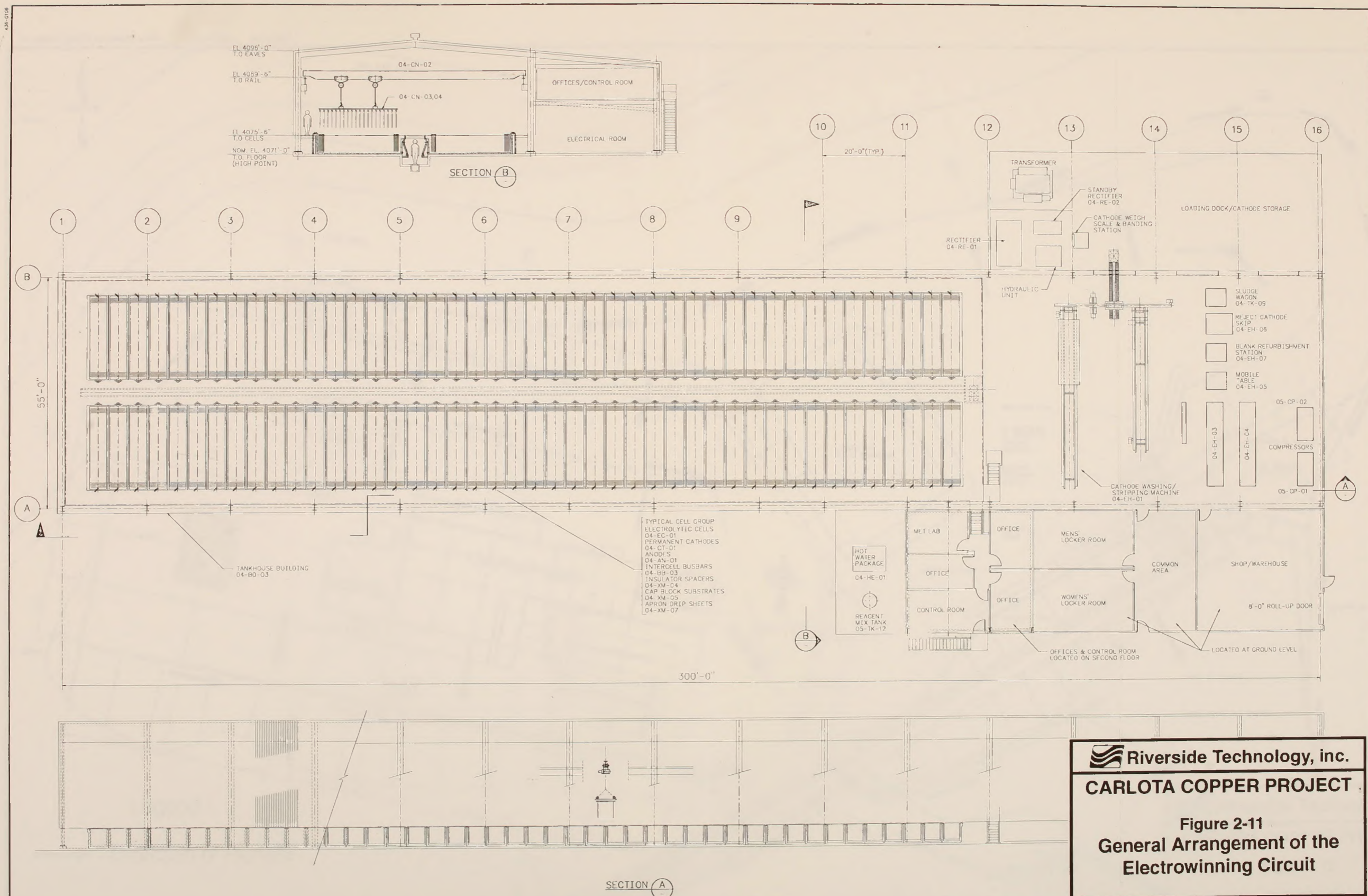
The SX mixer/settler tanks, EW building (tank house), laboratory and plant office building, and the associated solution storage tanks comprise the SX/EW plant area, located on the ridge between the Carlota/Cactus pit and the leach pad (*Figures 2-1a and 2-1b*). The SX/EW plant offices, a small plant shop/warehouse, a complete laboratory, and a control room would be located in several annexes in the immediate plant area. The laboratory would include a sample-preparation room and metallurgical and assay laboratories for running the daily blasthole assays and analyzing the process solution chemistries. These facilities would be located at ground level for accessibility of bulk materials. The central control room would have views over the SX area and tank farm and direct access to the tank house. The SX/EW plant area would cover approximately 8 acres. The SX/EW plant, the plant PLS/SX pond, and the raffinate pond, which would be located in a saddle area directly south of the plant and against the east edge of the leach pad, would make up the project components in the process area. The overall process area, which would include buffer areas, such as the hillside between the SX/EW plant and plant PLS/SX and raffinate ponds, would cover approximately 29 acres.

2.1.5.3 Administration Building and Other Ancillary Facilities

The administration building would be located east of the Carlota/Cactus pit and adjacent to the main access road to the project site, approximately 0.2 mile from the existing Pinto Valley Mine access road. The

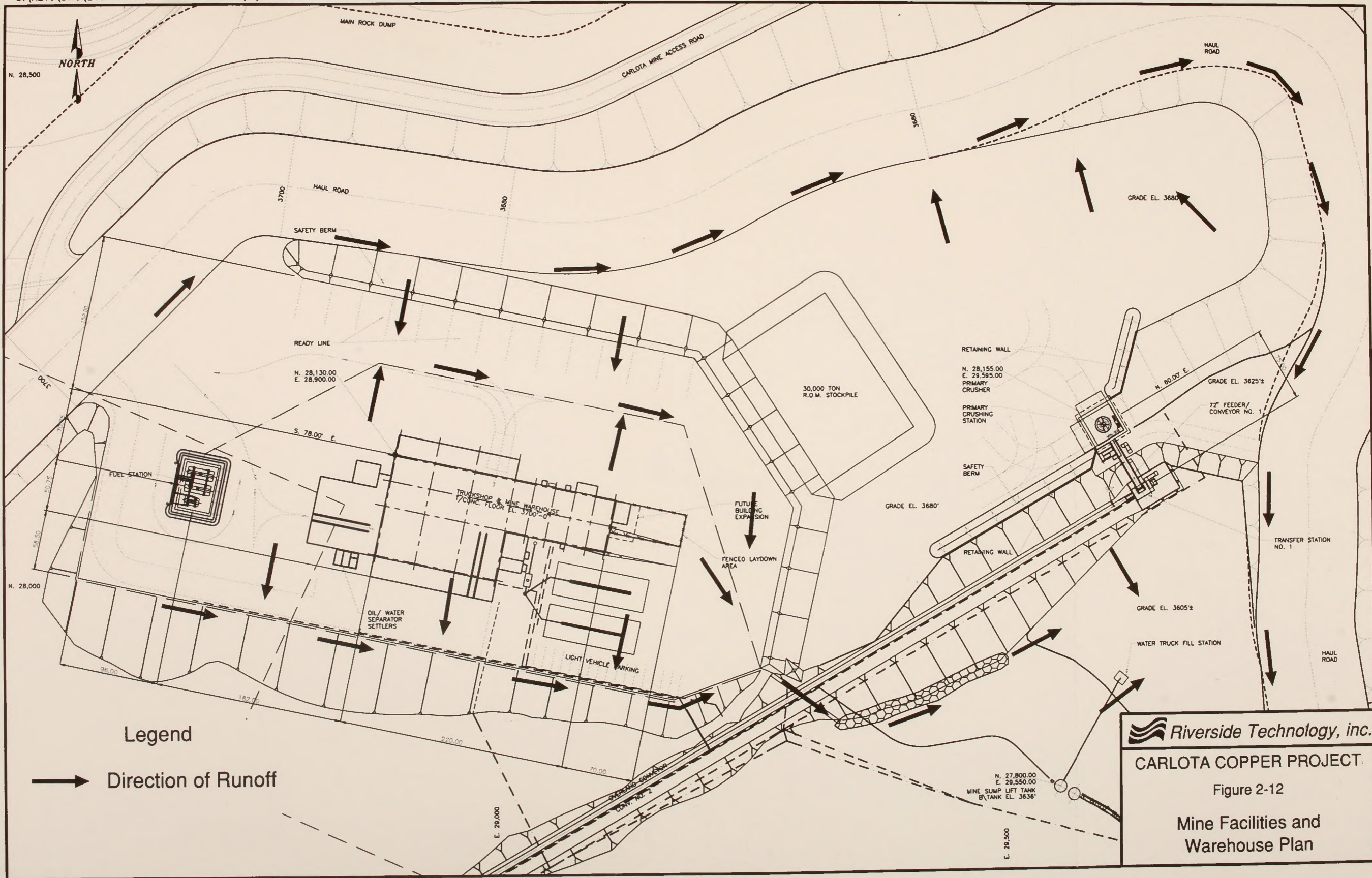


Riverside Technology, inc.
CARLOTA COPPER PROJECT
 Figure 2-10
 Solvent Extraction/
 Electrowinning Plant Site Plan



Riverside Technology, inc.
CARLOTA COPPER PROJECT
Figure 2-11
General Arrangement of the
Electrowinning Circuit

COPYRIGHT © This drawing contains the property of MINPROC En- gineers Inc. and may not be copied in any way without prior written ap- proval from this company.		MINPROC ENGINEERS INC. SUITE 8300 5400 SOUTH QUEBEC ST., ENGLEWOOD, COLORADO 80111 TELEPHONE: (303) 781-9111 FAX: (303) 781-9008	PROJECT APPR. <i>[Signature]</i> BY T.J.G. DATE 10/23/92 DESIGN APPR. T.J.G. DATE 10/1/92 DESIGNED M.E.L. DATE 10/1/92 CHECKED L.S.L. DATE 10/19/92 DRAWN F.X.T. DATE 10/12/92		CLIENT CARLOTA COPPER COMPANY CARLOTA COPPER PROJECT TITLE ELECTROWINNING AREA GENERAL ARRANGEMENT PLAN & SECTIONS	SCALE 1/8"=1'-0" 11.71 - 4.36 436-04/G-106
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Riverside Technology, inc.
CARLOTA COPPER PROJECT
 Figure 2-12
Mine Facilities and Warehouse Plan

administration building would include offices for senior project management, accounting, engineering, environmental, personnel, and purchasing staff. Parking lots would also be located adjacent to the administration building for both employees and visitors. A security system and a guard house would be located adjacent to the Pinto Valley Mine access road to control ingress and egress to the project area via the mine access road past the administration building. The facilities in this area would also include safety and training classrooms, as well as showers and locker rooms for project employees. These change-room facilities would be located in a separate building next to the administration building.

Privately owned employee vehicles would not normally be allowed beyond the employee parking lot. In order to reduce traffic on the mine access road, employees would be picked up at the administration building area in company vans or buses and transported to their work areas in the mine or process areas.

2.1.5.4 Sanitary and Solid Waste Disposal Facilities

Treatment facilities would be constructed to receive sewage flows from various project areas. Each separate facility would have a septic tank and leach field located nearby for treatment of waste water. These septic systems would consist of a septic tank, distribution box, and leach field. The waste solution would flow into each septic tank, located next to the respective project facility area. Overflow water from the septic tank would be routed to a distribution box. The distribution box would route the solution to a leach field, where a series of perforated pipes would

distribute the solution into the soil. Each leach field would be sized to allow the required absorption rates for dissipating the solution. The removal of sludge from septic tanks may be necessary in the latter years of the project. Sludge would be collected by licensed carriers and disposed of off the site at a state-permitted facility.

It is anticipated that a sewage system as described above would be required for the administration building, locker room and shower building, truckshop, and SX/EW office area. Each system would be sized according to the guidelines provided by ADEQ and for the approximate capacities and leach field sizes listed in *Table 2-5*. The septic system design would be finalized prior to project construction and would be designed to comply with appropriate regulations to ensure adequate performance given the site conditions and the work force. No potential sources of hazardous materials would feed into these septic systems.

Sanitary facilities (portable toilets) would be provided in the mine area. Waste from the portable toilets would be collected on a set schedule by licensed carriers and disposed of off the site at a state-permitted facility. Solid wastes that cannot be recycled, such as wood, garbage, and used tires, would also be disposed of off the site at facilities permitted by the State.

2.1.5.5 Stormwater and Spill Control Systems

Carlota has prepared a Storm Water Pollution Prevention plan (SWPP) to address site drainage and control of potential runoff-borne pollutant sources (including sediments) in stormwater runoff (Carlota 1994). Carlota has submitted a detailed

Table 2-5. Locations and Approximate Capacities¹ of Sewage Treatment Facilities

Facility	Capacity (gpd)	Septic Tank Size (gal)	Leach Field Area (sq ft)
Administration Building (60 people at 35 gpd)	2,100	3,000	3,400
Locker Room and Shower (80 people at 35 gpd)	2,800	3,500	5,000
Truckshop (40 people at 35 gpd)	700	2,000	1,200
SX/EW Office (10 people at 35 gpd)	350	1,500	600

¹Since percolation tests have not been completed, the estimates are expected average values.

system design that would be updated prior to the start of construction. The SWPP plan would meet federal and state requirements for protecting water quality. In addition, a Spill Control and Hazardous Materials Management (SCHMM) plan has been drafted to address hazardous materials, spill prevention, and response on the site (Carlota 1996a). Carlota has submitted an NPDES permit application to the EPA. Agency approval of these documents and applications would be required prior to project operations.

The SWPP and SCHMM plans identify Best Management Practices (BMPs) and compliance evaluations to be used in pollution prevention and response. The NPDES permit application also identifies proposed BMPs and compliance evaluations. EPA may impose additional conditions or requirements in the final NPDES permit. Secondary containment for process and storage components, erosion and sediment controls, employee training, site inspections, housekeeping, and maintenance are examples of preventive measures that would be implemented in the project area. The organization of response teams is recognized as an essential element in both the SWPP and the SCHMM plans and is provided to the extent possible at the current phase of the project. Detailed specifications and designs would be completed prior to the start of construction. The plans would be reviewed and updated as necessary during the course of the project.

As described in the SWPP plan and the NPDES permit application, surface runoff from areas upstream of the project facilities would be intercepted and diverted to natural drainages downstream. Diversion channels and interceptor ditches would be used at the open pits to collect and convey undisturbed surface runoff and streamflow around the pits. The mine rock disposal areas would have upgradient interceptor ditches to convey runoff from undisturbed areas to natural drainages. The tops of the mine rock disposal areas would be graded away from the embankment crests to prevent runoff from flowing down the dump face. Storm runoff from the tops of the mine rock disposal areas would be temporarily detained on the tops of the disposal areas. Catchment basins and/or the sediment-control BMPs constructed downgradient of the mine rock

disposal areas would control excess sediment runoff originating on the disposal areas.

Runoff from areas upgradient of the plant PLS/SX pond and the raffinate pond would be collected by diversion channels along the north and south sides of these facilities. Storm runoff from the hillside to the east of the leach pad would be collected by the east diversion channel and routed to the inlet control structure. Storm runoff from the SX/EW plant area would be routed through a collection pipe to the raffinate pond. Storm runoff from the natural slopes below the SX/EW plant area would report to the north diversion channel and would be routed to the leach pad. Stabilized inlets would pass through the leach pad berm, allowing this runoff to drain to the leach pad. Routing of storm runoff on the south side of the raffinate pond has been revised per discussions with the EPA for the NPDES permit. Storm runoff collected from this area and from the area of the Cactus Southwest mine rock disposal area would be routed through the diversion channel south of the PLS/SX and raffinate ponds to the Carlota/Cactus pit to the east (Knight Piésold 1996i).

The larger stream diversions around the Carlota/Cactus pit and the heap-leach pad would be permanent structures. Specific diversion designs would be reviewed and approved by the Forest Service, the COE, and appropriate state regulatory agencies prior to construction.

To minimize the potential for increased sediment yield that may be attributed to areas of disturbance, all or a combination of the following basic erosion and sediment control BMPs would be used. These measures include (1) sloping mine access and haul roads into the hillside to prevent erosion of the fill embankment and to promote deposition of road sediments within the roadway grader ditches, (2) installing sediment barriers to intercept and retain sediment immediately downslope from the disturbance site (typical examples of barriers include straw bales and silt fences), (3) constructing temporary diversion dikes that can divert surface runoff away from the unprotected slopes of disturbed areas, (4) designing and constructing perimeter berms at the top of the rock dumps to prevent drainage down the face of the slopes, and (5) installing temporary sediment traps or basins that can

be sized to accommodate sediment discharge from one or more subbasins (Carlota 1994a).

Mine facilities areas would be graded to minimize erosion and limit surface runoff. On primary roads, a series of ditches and culverts would be established to collect and convey surface runoff to natural drainages (Carlota 1993a).

The SCHMM reviews potential contaminant sources within the proposed project area and identifies proposed protective measures for each project component. Containment and secondary containment technologies are identified for process components and ancillary facilities, including the heap-leach pad, raffinate and PLS ponds, pipelines, the plant site, tank farm, maintenance and shop facilities, roads, office, laboratory, and associated storage areas and infrastructure. The equipment, materials, and quantities likely to occur on the site are also described. Inspections, record-keeping, and contingency approaches with regard to incident coordination and emergency response are also addressed (Carlota 1996a).

2.1.6 Utilities, Equipment, Vehicles, and Supplies

2.1.6.1 Water Requirements and Supply

Make-up water requirements for the project have been estimated to average approximately 590 gpm annually (approximately 950 acre-feet per year), with a high make-up water demand during average dry months of approximately 850 gpm. Water is required for leach losses, plant and mine shop use, dust control, and a potable supply, as summarized in

Table 2-6. During dry periods of the year, the proposed project would require approximately 350 (gpm) of fresh water for non-leach plant uses, including boiler feed, dust control, washdown, and potable supply; non-potable, lower-quality water could be used to supply the remaining 500 gpm (59 percent of the project water needs) for leach loss makeup.

This water would be supplied by dewatering the pits (including proposed Well TW-5) and installing up to five bedrock wells in the Pinto Creek well field area. A water right will be required by the Arizona Department of Water Resources for any water used for the project that is appropriable surface water. Well TW-5 is a proposed water supply/pit dewatering well located southwest of the Carlota/Cactus pit along the trace of the Bundy fault (*Figure 2-2*). The planned target depth for Well TW-5 is on the order of 500 feet.

The well field would be located along Haunted Canyon and Pinto Creek approximately 2 miles north of the SX/EW plant (*Figure 2-2*). This water supply would require the construction of an access road, pipeline and overhead power line, and associated pumping equipment to transport the water from the well field area to the project site.

The well field would consist of five wells approximately 1,000 feet deep. Field tests of three existing test wells indicate that pumping rates ranging from 75 to 600 gpm per well could be achieved. These rates, along with pit dewatering, are sufficient to supply the mine's average and peak water demands. Using this well field would disturb approximately 8 total acres for well sites, pipeline, pump station, power line, and access roads.

Table 2-6. Estimated Water Requirements

Use	Yearly Average Demand (gpm)	Typical Dry-Month Average Demand (gpm)
Leach Losses—Evaporation, Retained Moisture, etc.	240	500
Non-leach Plant Uses—Boiler Feed, Reagent Dilution, etc.	100	100
Mine Roads-Dust Control	100	100
Crushers-Dust Control	100	100
Washdown, Potable	50	50
TOTALS	590	850

Currently, three water supply test wells have been installed in the well field on the west side of Pinto Creek; two just below the confluence of Pinto Creek and Haunted Canyon, and one near the confluence of Haunted Canyon and Pinto Creek. The three existing wells were installed to test the production capacity of the bedrock aquifer. The existing wells are 1,500 to 2,000 feet apart; two additional wells are proposed and would be located between the existing three, for a proposed total of five wells in the well field.

Ground water would be pumped from the series of three to five wells into a header or collection pipe that would convey the water to a holding tank near the confluence of Pinto Creek and Haunted Canyon. A booster pump located near the holding tank would pump water uphill to the 300,000-gallon primary water storage tank located on the ridge at the northwest corner of the main mine rock disposal area. From this tank, water would be pumped to the SX/EW plant and the other project facilities.

The total elevation difference between the well field and the SX/EW plant area is approximately 700 feet. The header piping would be approximately 0.6 mile long, while the main water supply pipeline from the booster pump to the SX/EW plant would cover a straight-line distance of approximately 1.3 miles. Because of the elevation difference and intervening terrain, the main water line would follow a somewhat longer circuitous path. The pipeline corridor would cross Haunted Canyon in the vicinity of the southernmost water well and proceed to the south, up a small drainage that starts at the junction of Pinto Creek and Haunted Canyon. The head of this small drainage is directly adjacent to the northwest boundary of the Main rock dump. The pipeline would proceed to the SX/EW plant area, through the Main mine rock disposal area (either buried under one of the upper lifts or routed along one of the benches) and along the ridge that divides Pinto Creek from Powers Gulch (Carlota 1994b).

A single-lane service or access road would parallel the main pipeline and the collection header in the well field area. A small overhead power line would generally follow the alignment of the pipeline and service road to supply power to the submersible pumps in the wells, as well as the booster pump. The

pipeline would be constructed from HDPE plastic or steel, depending on the pressure requirements, and would measure approximately 10 inches, inside diameter. During project operation, access to the well field area would be provided from both the south and the north. Access from the south would be from the Main mine rock disposal area and along the service road that would generally parallel the water pipeline.

This access road would make an unimproved crossing of Haunted Canyon to allow seasonal access during low-flow periods. The proposed access from the north would use the Iron Bridge, located north of the well field, to cross Pinto Creek. From the Iron Bridge, the access road would parallel the west side of Pinto Creek and would be placed higher up on the hillside to avoid additional disturbance in Pinto Creek (*Figures 2-1a and 2-1b*).

This access road would require approximately 0.8 mile of new construction, and the existing 0.8 mile of access road connecting the three wells would be upgraded. The access roads would be single-lane and would have a drainage ditch and culverts as required. As stated previously, the proposed well field would disturb approximately 8 acres, including the well sites, pipeline, pump station, power line, and access road.

2.1.6.2 Power Requirements and Supply

The power requirements of each area of the project have been estimated based on the installed motor powers and normal plant loading factors. The total peak demand for all areas of the project is estimated at approximately 17 megawatts, with the average operating load estimated at approximately 14.7 megawatts. The Salt River Project would supply electrical power to the project. Standby diesel power generation would be provided by Carlota as emergency backup power for the solution recovery system pumps.

The proposed power line route is shown in *Figures 2-1a and 2-1b*. The new power line would tie into an existing 115-kv Salt River Project power line, which runs north from U.S. Highway 60, parallel to the Pinto Valley Mine road and east of the Cottonwood tailings site, to the Castle Dome Substation.

The Salt River Project would provide a tap into the existing 115-kv power line and would construct a 22-kv substation at the tap point. A new 22-kv overhead power line would be constructed from this substation to the Carlota process plant area. The power line corridor would be approximately 15 to 20 feet wide and 3.5 miles long, resulting in approximately 6 acres of disturbance. New disturbance caused by the power line would include access to pole sites and areas of excavation. Disturbed areas would revegetate naturally or be reseeded, as necessary. The power line structures would be treated-timber, single-pole construction. The 22-kv substation, along with the tap line connecting it to the 115-kv power line, would be permitted, owned, constructed, and maintained by Salt River Project. The 22-kv power line would either be included in Carlota's Operating Plan or permitted as appropriate, and would be constructed, and maintained by Carlota.

The existing 115-kv power line would be tapped just south and east of the Cottonwood tailings site. The 22-kv substation would be located directly south of the Pinto Valley Mine road. The new 22-kv power line would run adjacent to the Pinto Valley Mine road to the Carlota administration building site. From there, it would continue on private property, generally following the mine access road, to the crusher/mine shop area on the west side of Pinto Creek. It would continue around the northwest side of the Carlota/Cactus pit to the secondary crusher site and the SX/EW plant area, then northwestward to the proposed well field.

2.1.6.3 Communications

Primary on-site communications would be via FM radio. Communication with areas off the site would be via standard telephone lines tied into the U.S. West Communications service.

2.1.6.4 Major Equipment and Vehicles

Mining and Support

Mine mobile equipment requirements were calculated based on the annual mine production schedule, the mine work schedule, and equipment shift production estimates.

The mining equipment requirements represent the equipment necessary to perform the following functions:

- Construct initial out-of-pit mine haul roads from the pit area to the ore crusher, leach pad, and mine rock disposal areas.
- Mine and transport mine rock from the pit area to the mine rock disposal areas.
- Mine and transport ore material from the pit area to the primary crusher.
- Haul ore from the secondary crusher stockpile to the leach pad area (pad haul truck).
- Haul Eder ore from the Eder primary crusher to the leach pad area.
- Maintain the mine rock disposal areas and move the conveyor/spreader system on the leach pad.
- Maintain all mine working areas, in-pit haul roads, and external haul roads.
- Transport and distribute water and chemicals for dust suppression.
- Move and compact soil for soil salvage and pad liner construction.
- Support operations not specifically related to mine production.

Open-pit mining would be conducted with hydraulic shovels and trucks to haul ore to a primary crusher site located north of the Carlota/Cactus pit or at the Eder South pit, and trucks to haul mine rock to the disposal areas.

Typical blasthole drilling would be performed by a fleet of two crawler-mounted, diesel-powered units. Blastholes would be drilled with a 9.75- to 12-inch rotary bit and spaced approximately 20 to 35 feet apart.

The proposed mine loading fleet would consist of two or three hydraulic front-shovels in the 13.5- to

17-cubic-yard-capacity class. The shovels would load ore and mine rock into haul trucks. The fleet of three hydraulic shovels would provide good coverage of the two to three active mining areas. These shovels can work a 40-foot-high bench and are matched well with the proposed haul trucks. A 13.5-cubic-yard wheel loader is part of the mine support equipment and can be used as a backup production unit.

The proposed mine hauling fleet would consist of a maximum of nineteen 90-ton-capacity or twelve 150-ton haul trucks. Ore and mine rock would be hauled from the mining face to the respective primary crusher or rock disposal area locations. Units from the mine hauling fleet would also be used to haul Eder ore from the Eder primary crusher to the leach pad area. If ore is not conveyor-stacked on the leach pad, a separate fleet consisting of two or three 90-ton units (pad haul trucks) would be used to haul and stack crushed ore on the active level of the leach pad. Auxiliary equipment (including dozers, graders, water trucks, service trucks, etc.) would be used to support the major production units and to provide safe and clean working areas. Auxiliary equipment refers to the mine equipment units that are not directly responsible for production, but that are scheduled on a regular basis.

The major mining and support equipment and vehicles are listed in *Table 2-7*.

Processing

The major equipment required for ore processing includes the following:

- Primary crusher: 54- by 74-inch gyratory, capacity 2,500 tons/hour Overland conveyor: two 48-inch-wide, cable-supported conveyors (total length 3,100 feet)
- Coarse-ore stacker with reclaim: radial-arm stacked 5 separate reclaim points
- Secondary crusher: 7-foot standard cone, capacity 1,250 tons/hour

- Leach pad distribution conveyors: series of portable grasshopper conveyors, 100 to 150 feet long, 42-inch-wide belt
- Self-propelled radial stacker, 42-inch-wide belt, or three 90-ton haul trucks

2.1.6.5 Hazardous Substances

A description of the proposed transportation, handling, storage, use, and disposal of hazardous substances for the Carlota Copper Project and the potential impacts are addressed in Section 3.14, Hazardous Materials.

2.1.7 Site Access and Project Traffic

2.1.7.1 Proposed Access

The proposed access to the project site would be via the existing paved road, which runs north from U.S. Highway 60 to the BHP Copper Pinto Valley Mine operation. Access to the project from the paved road would be provided by constructing a short stretch of new road from the Pinto Valley Mine road to the Carlota administration building (*Figures 2-1a and 2-1b*). The turnoff from the Pinto Valley Mine road would be 2,200 feet south of the Pinto Valley Mine main gate. A gravel access road would be constructed to connect the new administration building with the mine and processing areas on the west side of Pinto Creek (*Figures 2-1a and 2-1b*). The access road would be 24 feet wide with 4-foot-wide shoulders and would be designed for a speed of 30 mph at a maximum road grade of 8 percent. Drainage control would be provided by ditches and culverts. The unpaved segment of the access road would be graded as necessary for proper maintenance. Gravel would be placed on the road as needed to maintain a smooth, all-weather surface for heavy truck traffic. Chemical dust suppressants and water would be used to reduce dust emissions from the access road.

The mine access road crossing of Pinto Creek would include a culverted section to handle the normal streamflows and an overflow section to handle the flows associated with larger storm events. Three

Table 2-7. Estimate of Major Mine Equipment Requirements

Major Mine Equipment	Class or Size	Number
Blasthole Drill	75,000 lb	2
Hydraulic Front-Shovel	13.5 cu yd	3
	<i>or</i> 17 cu yd	<i>or</i> 2
Wheel Loader (backup)	13.5 cu yd	1
Haul Truck (rear dump)	90 ton	19
	<i>or</i> 150 ton	<i>or</i> 12
Track Dozer	170 net HP	2
Track Dozer	370 net HP	2
Rubber-Tired Dozer	310 net HP	2
Motor Grader	16 feet	2
Water Truck	8,000 gallon	2
Air-Track Drill	3 inch	1
Fuel/Lube Truck		1
Rubber-Tired Backhoe	1.5-3 cu yd	1
Anfo/Slurry Truck	N/A	1
Blasthole Stemming Tractor	N/A	1
Man Vans	N/A	2
Pickups	N/A	15
Ambulance	N/A	1
Flatbed w/Boom	N/A	1
Tire Handler	N/A	1
Mechanic's Service Truck w/Welder	N/A	2
Rough Terrain Crane	N/A	1

10-foot-diameter culverts, which would handle the peak discharge from the 10-year thunderstorm event, would be installed. Streamflows too large to pass through the culverts would flow over the road at a reinforced overflow section. One other temporary crossing over Pinto Creek would be installed for use during the first 2 years of the project. Although the first phase of mining in the Carlota/Cactus pit would not require relocating Pinto Creek and would be located entirely on the east side of Pinto Creek, the primary crusher, mine rock disposal area, and mine shop would be located on the west side of the creek; the temporary crossing would be required to reach these facilities. This temporary crossing would also include culverts designed to pass the peak flow resulting from the 10-year thunderstorm.

2.1.7.2 Project Traffic

The access road would be used by all types of vehicles that operate legally on federal highways. *Table 2-8* provides a listing of the anticipated usage by vehicle type and frequency.

Passenger cars and trucks would be used by mine workers, vendors, and other visitors. The mine, leach pad, and process plant employees would be transferred between the administration office parking lot and their work areas via company vans or buses. Passenger buses would be used for occasional group tours. Light and heavy delivery trucks, including tractor-trailer rigs, would be used to deliver supplies and spare parts. Tanker trucks would be used for

Table 2-8. Anticipated Project Access Road Usage

Vehicle Type	Estimated Frequency ¹ (vehicles per day)
Passenger Vehicles; Company Vans or Buses	100
Passenger Buses	Occasional
Light Delivery Trucks	5
Heavy Delivery Trucks	2
Tanker Trucks	18
Cathode Transport Trucks	4
Equipment Transporters	Occasional
Mobile Cranes	Occasional

¹Round trips

delivering bulk liquids, principally fuels and sulfuric acid. Copper cathodes would be transported from the mine on flat-bed trucks.

Equipment transporters (low-boys) would be used to transport heavy equipment to and from the operation. Items typically transported would include tracked equipment, disassembled off-road trucks, front-end loaders, large excavators, crushers, and heavy components. Large mobile cranes would be called to the mine for occasional heavy lifts.

2.1.8 Construction and Operational Considerations

2.1.8.1 Construction and Operations Personnel

Construction

The construction period for the project is estimated to be approximately 10 months. This construction would include erecting all structures and utilities and preparing the leach pad area. Construction is expected to begin immediately following acquisition of requisite

permits and final approval of the Plan of Operations. The construction workforce would average approximately 91 workers per month, with a peak at approximately 177 workers. An estimate of the number of construction workers on the site, by month, for a 10-month construction period is presented in Table 2-9.

Carlota is planning on contracting most of the construction for the project facilities. Carlota may also complete some of the construction tasks with its own equipment and employees. The construction company has not been selected, and the breakdown of local and non-local construction workers is not currently known. Carlota realizes, however, that there are a large number of well-qualified construction and mining- industry workers in the Globe-Miami-Superior area, as well as within commuting distance from Phoenix. In addition, a number of construction companies and subcontractors that could be used during construction have been identified in both the Phoenix and Tucson areas. Carlota intends to use local construction workers to the maximum extent possible.

Table 2-9. Estimate of Construction Workforce Requirements

Construction Month	1	2	3	4	5	6	7	8	9	10
No. of Construction Workers	27	50	78	131	177	168	112	75	70	25

Operation

The Carlota Project is estimated to have a total project life of up to approximately 23 years based on the schedule of activities presented in *Table 2-10*.

Table 2-10. Anticipated Schedule of Project Activities

Activity	Duration (years)
Construction/Start Up	~1
Mine Production	15
Recovery of Copper from Heap After Mining Ceases	5
Closure and Reclamation	2
TOTAL	23

The Carlota Copper Project mining plan specifies an initial average of 282 employees during the first 7 years, rising to a peak employment level of 301 employees in Year 8, and declining to an average of 255 during the following 7 years of operations. While most of the jobs would be filled by local residents, it is expected that 25 to 30 employees may be hired from outside the local area. Average employment during the 15-year mine production period would be 255 employees.

2.1.8.2 Security, Health, and Safety

Project operations would be conducted in accordance with both federal and State requirements and guidelines. The MSHA enforces federal regulations. The Arizona State Mine Inspector (ASMI) enforces the requirements of the State Mining Code. Security and safety measures would be implemented to protect mining and operations personnel and the general public. These measures would incorporate physical barriers, such as fencing and berms, with appropriate signage, and the implementation of safety training procedures.

Fencing, Barriers, and Signs

Fencing would be used to control access and to preclude access to potentially hazardous areas. Most facilities would be surrounded with barbed-wire fencing that would be built to Forest Service specifications and would restrict access to designated points. Other physical barriers, such as earthen

berms, would be employed to restrict vehicle access at certain areas, including the mine pits, the mine rock disposal areas, and along haul roads.

Warning signs would be posted at regular intervals on perimeter fencing around the various facilities and at potential access points. Road signs and maximum speed limits would be posted along access routes.

Security and Safety Procedures

Project security would be provided by trained security personnel. Safety for the general public would be provided by the physical barriers and by project security. Visitors to the Carlota Copper Project would be limited to specific areas and guided by project personnel. Large mobile mining equipment, such as haul trucks and loaders, would not use roads accessible to the general public unless preceded by a pilot car. Public traffic would be restricted beyond the access to the administration area.

Procedures established by MSHA and ASMI would be strictly followed to protect the health and safety of the general public and project employees. In accordance with these guidelines, employees would receive regular first aid and safety training for their specific tasks, such as operating equipment. Personnel in the processing area would receive training in handling reagents and would be familiar with a plan for containing and cleaning up potential spills (Carlota 1996a). A vehicle would be available on the site to transport personnel to a hospital in the event of an injury.

2.1.8.3 Fire Protection

A portion of the 300,000 gallons of stored water in the tank located near the main mine rock disposal area would be maintained as a fire protection reserve. Fire extinguishers would be installed as appropriate in project support and ancillary facilities, at intervals along the conveyors, and in company vehicles.

2.1.9 Carlota's Proposed Reclamation and Closure

The primary goal of site reclamation is to ensure long-term protection of the environment and to return disturbed areas to a condition suited to the

postmining land uses of wildlife habitat, livestock grazing, watershed protection, dispersed recreation and wilderness access, and mineral exploration. To this end, the sub-goals are (1) to minimize or eliminate public safety hazards and (2) to diminish the prominence of man-made landscape features. Proposed reclamation activities are described generally below, and are described in further detail in the project Reclamation and Closure Plan (Carlota 1994a). This is a separate interim document that supplements the Plan of Operations. A final Reclamation and Closure Plan will be approved by the Forest Service, and will become part of the Plan of Operations.

Carlota's proposed reclamation and closure activities are divided into two major categories: concurrent reclamation practices (those reclamation activities that are conducted during active mining) and final reclamation and closure.

2.1.9.1 Concurrent Reclamation

Carlota's proposed plan for concurrent reclamation includes the following measures.

- During the site preparation phase of the project, disturbed surfaces would be contoured to minimize erosion and provide adequate drainage. Sediment traps would be installed downstream of disturbed areas. New traps would be developed along with new areas of disturbance. Erosion control measures, such as rock check dams, straw bales, and siltation fences, would be implemented as needed along roads and near other disturbed areas to minimize the accelerated erosion and sedimentation of surface drainages. Sediment control structures would be constructed at natural low elevation points at the toes of the Main, Cactus Southwest, and Eder mine rock disposal areas. These structures would be located as shown in *Figure 2-1b*. The design of these structures has been incorporated into a storm-water permit application, and the structures would be operated in accordance with an approved SWPP Plan and NPDES permit as required by the CWA stormwater permit program. At closure, the sediment ponds would be replaced with appropriate non-retaining controls, such as rock check dams, if necessary.
- Salvageable soil would be removed from the areas to be developed or disturbed. This soil would be stored in stockpiles, stabilized, and seeded to protect it from wind and water erosion. Some of the subsoil and weathered bedrock at the leach pad area would remain in situ for construction of the engineered subgrade for the leach pad liner system. Salvage operations would be limited to slopes less than 30 percent because of equipment safety considerations. The approximate soil volumes available for salvage for the proposed action are shown in *Table 2-11*. To the extent practicable, topsoil stockpiles would be located in areas not subject to disturbance from mining operations. Physical disturbance of the stockpiles would be minimized. Seed Mix S (*Table 2-12*) would be planted to protect the stockpile surfaces from erosion.
- The construction sites and borrow pits would be confined to areas to be covered by project components or developed during the mine life, if possible.
- Runoff diversion ditches would be installed around disturbed areas and would be extended and rip-rapped as needed.
- During the life of the mine, areas no longer needed would be reclaimed and revegetated with plant species that are most suitable for the growing conditions at the various sites. A plan to mitigate impacts to Arizona hedgehog cactus has been developed and accepted by the U.S. Fish and Wildlife Service.
- The Carlota/Cactus pit would be partially backfilled.
- Full-scale testing of reclamation and closure alternatives for the heap would be conducted in the north pad area prior to the end of the project. Selected portions of the mine rock disposal areas would also be used for reclamation testing prior to the end of mining. In addition, a testing program would be implemented to determine necessary seedbed amendments and preparation, which would be performed as needed. The methods of seeding and establishing vegetation would be

Table 2-11. Proposed Soil Volumes for Salvage as Topsoil for Reclamation

Disturbed Areas	Acres	Recoverable Soil (yd ³)
Main Mine Rock Disposal Area	227	0
Cactus Southwest Mine Rock Disposal Area	100	0
Eder Mine Rock Disposal Area	73	88,852
Total Mine Rock Disposal Areas	400	88,852
Carlota/Cactus Pit	320	96,081
Eder North Pit	34	2,592
Eder South Pit	81	4,485
Total Pits	435	103,158
Leach Pad	313	192,291
Ponds	6	1,262
Facilities	105	71,927
Roads	161	85,250
Well/Field Components	8	0
Total Other	593	350,730
TOTAL ALL AREAS	1,428	541,478
Soil for Salvage = 541,478 yd³ x .85 loss factor = 460,256 yd³		

reviewed before planting. Drill seeding is proposed where topography and site conditions allow. Hydroseeding and other broadcast seeding methods may also be employed as site conditions dictate.

- Optimal seeding times would be discussed with land management agency specialists. The seed mixture would consist of grasses, forbs, and shrubs. Opportunities for innovative reclamation practices may emerge, particularly for wetland/riparian replacement and cactus habitat replacement, and these practices would be implemented, if appropriate (Carlota 1994a).

2.1.9.2 Final Reclamation and Closure

During closure of the mine, Carlota proposes specific actions for the various facilities. These actions are described in the following sections.

Open Pits

Public access to the pits would be blocked by placing rock berms on all roads leading to the pits. A barbed-wire fence would be erected to provide additional protection against entry, if directed by the Forest

Service. Weather-proof "dangerous condition" signs, as required by Arizona State statute, would be posted at intervals along the rock berm to provide notice to the public.

No revegetation of the benches or pit walls is proposed. Pit walls and benches would fill with rubble from higher benches, gradually diminishing the terrace-like appearance. Since the Carlota/Cactus pit is located in a canyon, and much of the pit is below the level of the natural ground surface, only portions of the pit would be visible. The pit bottoms can be expected to accumulate water from runoff and ground water seepage after abandonment.

The Carlota/Cactus pit would be partially backfilled toward the end of mining. Material removed from the Carlota portion (west side) of the pit would be hauled south and east through the pit and would be deposited in the Cactus portion (east side) of the pit. Approximately 52 million tons of material would be backfilled. This backfilling technique would have at least three beneficial effects. First, the backfill would buttress the in-pit side of the Pinto Creek diversion channel. Second, the backfill would reduce the amount of material otherwise destined for the Main rock dump, thus lowering the final dump elevation.

Table 2-12. Proposed Seed Mixtures for Reclamation Plan

SEED MIX S ¹			
Species Common Name	Seeding Rate (pounds/acre)	Seeds/Pound	PLS ² Seeds/Foot ²
Grasses:			
Oats	15	13,000	4
Yellow Sweetclover	4	260,000	14
Weeping Lovegrass	4	1,500,000	28
TOTAL	23		51
SEED MIX L ¹			
Grasses:			
Sideoats Grama	2.0	191,000	7
Lovegrass	0.5	1,500,000	14
Red Brome	2.0	270,000	14
Galleta	2.0	159,000	6
Shrubs:			
Shrub Live Oak	To be determined on test plots		
Sugar Sumac	"	"	"
Pringle Manzanita	"	"	"
Pointleaf Manzanita	"	"	"
Desert Ceanothus	"	"	"
Wait-a-minute Bush	"	"	"
Cliffrose ³	2.0	65,000	3
Skunk Sumac ³	2.5	22,000	1
Forbs:			
Yellow Sweetclover	1.5	260,000	7
Desert Globemallow ³	0.5	500,000	7
Flat-Top Buckwheat ³	0.5	350,000	3
TOTALS:	13.5		58
Optional Grasses:			
Bermuda Grass	0.5	2,000,000	18
Purple Three-awn	2.0	250,000	9
Sand Dropseed	0.5	5,000,000	46
SEED MIX R ¹			
Grasses:			
Purple Three-awn	2.0	250,000	9
Sideoats Grama	2.5	191,000	9
Lovegrass	1.0	1,500,000	27
Sand Dropseed	0.5	5,000,000	46
Forbs:			
Yellow Sweetclover	2.0	260,000	10
TOTAL	7.5		102

¹Subject to substitutions and modifications²Based on an assumed 80 percent Pure Live Seed basis³Or similar

Third, the rock backfill would raise the elevation of the Cactus portion of the pit bottom, improving the final appearance of the pit. The backfilled material would be graded so that natural-appearing contours extend down to the diversion and tie in with the surrounding topography, providing a broader floodplain for Pinto Creek. The rock backfill in the Cactus portion of the pit would then be ripped to a depth of 4 feet and slightly graded to create a roughened seedbed. A surface material survey would be performed to determine if amendments could enhance vegetation establishment. After the application of amendments, if needed, the appropriate backfill surfaces (approximately 48 acres) would be drill seeded with an approved mixture to stabilize the surface.

The Eder pits would be located on the west hillside of Powers Gulch and would be partially backfilled with mine rock material. The pit bottom elevations prior to backfilling would be 3,880 ft-amsl for the Eder North pit and 4,080 ft-amsl for the Eder South pit. The final backfilled pit elevations would range from approximately 4,000 to 4,200 ft-amsl. Approximately 4 million tons of mine rock would be placed in the Eder pits; approximately 3 million tons would be backfilled during mining operations, and another 1 million tons would be backfilled into the pits from the Eder mine rock disposal area during reclamation and closure. The backfilled material would be contoured so that any precipitation captured by the pit highwalls and fill areas would exit the pit as stormwater runoff.

The backfilled floor of the Eder pits would encompass approximately 33 acres. A surface material survey would be performed to determine if amendments would enhance vegetation establishment on the pit floors. After the application of amendments, if needed, the backfill material would be drill seeded with an approved mixture to stabilize the surface (Carlota 1994a).

Following the backfilling of the Eder pits, approximately 8 million tons of mine rock would remain in the Eder mine rock disposal area and would cover approximately 61 acres; the top elevation would be approximately 4,240 ft-amsl.

Potential hazards to public safety would be minimized by using measures such as berming, fencing, or

filling. The postmining topography of the pits is shown in *Figure 2-13*.

Mine Rock Disposal Areas

The Main and Cactus Southwest mine rock disposal areas would be built using a bottom-up technique. Disposal areas would be constructed in layers, which would result in stepped topography as opposed to one long, continuous slope. The Eder mine rock disposal area would be built starting from approximately its final top elevation. The tops of the disposal areas would be sloped away from the crests during construction to keep the disposal area faces from eroding. The mine rock disposal areas would be configured to maximize the area of flat surfaces on top and to minimize runoff. This configuration would enhance reclamation practices in these areas. The sideslopes would be left at the angle of repose in order to maximize the flat surface areas and to minimize the height of the disposal areas and the area of disturbance. The toes of the disposal areas would be contoured to blend with surrounding topography, where feasible and where access permits (Carlota 1994a). The general postmining topography of the disposal areas is shown in *Figure 2-13*.

The flattened top surfaces of the disposal areas would be ripped to a depth of 4 feet and recontoured to form a roughened seedbed. The surfaces would be contoured to encourage infiltration and discourage ponding. Undulations would serve to enhance opportunities for establishing seeded and volunteer plant species.

The top surfaces of the mine rock disposal areas would be revegetated on a growth medium developed directly from waste rock. A surface material survey would be conducted prior to seeding to determine if amendments would enhance vegetation establishment. The top surfaces would be amended, as necessary, according to test results, and directly seeded with Seed Mix R (*Table 2-12*). Amendments may include fertilizers and mulches.

Heap-Leach Pads

The closure strategy of the leach pads accounts for the possible presence of acid within the spent ore and

is designed to minimize effluent discharge by conducting final grading that will ensure positive drainage from the surface of the heap and by establishing a multi-layered cover and evapotranspiration system to prevent water from entering the spent ore from surface percolation. Specific reclamation techniques would enhance runoff and evapotranspiration from the heap surface. These techniques would include preparing the soil and establishing specific vegetation types (Carlota 1994a).

The general sequence of closure events follows:

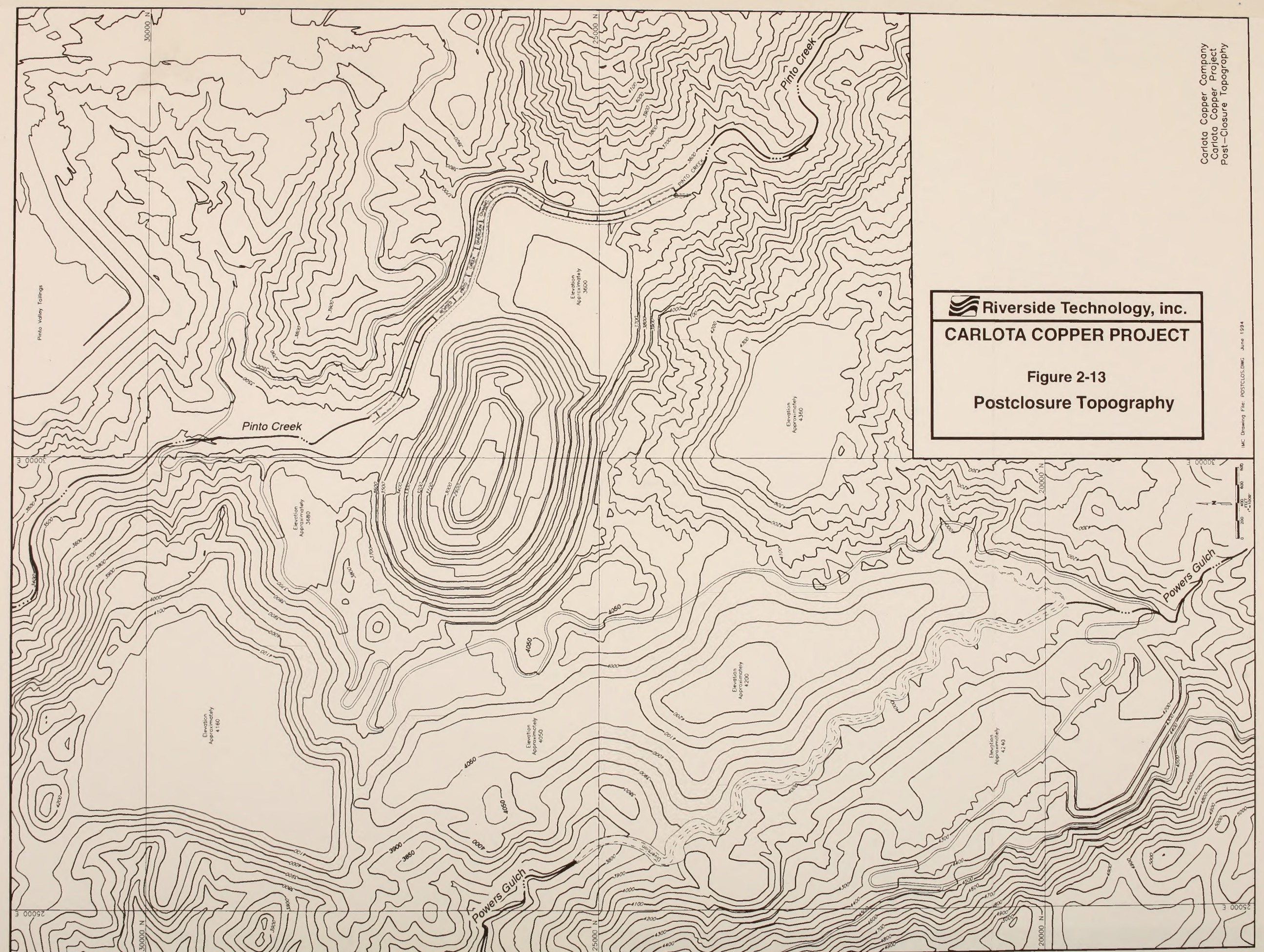
- End of ore addition to the heap, final economic recovery of metal, continued operation of the SX/EW plant
- Draining of the leach pad after SX/EW plant closure using high-evaporation sprinklers and pumping solutions back to the sprinklers; and/or temporary evaporation ponds on the top of the heap
- Reduction of the compound heap slopes to an overall slope of approximately 2.5H:1V
- Subsequent surface preparation of the heap to impede percolation from the surface to enhance runoff characteristics
- Preparation of a low-permeability zone within the multi-layer cover to retard infiltration into the spent ore (Hydraulic conductivity of the layer would be approximately 1×10^{-5} cm/sec in flat areas of the pad and would vary slightly on the steeper areas of the pad because of greater runoff coefficients in those areas (Carlota 1997). Preparation of the layer could include compaction and possibly the use of an amendment, such as bentonite or lime.)
- Placement of an upper soil layer (soil root zone and lateral percolation zone) consisting of approximately 4 feet of mine rock and 1 foot of topsoil (approximately 436,000 cubic yards of topsoil would be used)
- Final sloping and planting of selected vegetation to increase runoff and evapotranspiration

The SX/EW plant would continue to operate for a period of time after the last ore is stacked on the pad. The length of this period would depend on the amount of copper recovered as well as the copper price. During this period, the remaining solution volume in the pad would be steadily reduced using high-evaporation sprinklers. Make-up water would be used to aid in plant operation and/or to keep an adequate volume for efficient plant operation.

When economic recovery of metal is no longer possible, the pump-back phase would begin by pumping leachate directly to high-evaporation sprinklers. The solution volume would be rapidly reduced, and make-up water would no longer be added to the leach solution. Heap draw-down and dewatering are expected to take less than 1 year.

Recontouring the heap surface would be the next step and would begin while the pumpback/evaporation is going on. This recontouring would begin as sprinklers are removed and sections of the leach pad are taken off leach for the final time. The slopes of the heap would be graded to approximately 2.5H:1V. During grading, material would be moved into place to provide a continuous slope from the pad to the Powers Gulch diversion channel. The diversion channel would be reshaped as necessary to convey large flood events without impacting the stability of the heap or allowing flood waters to infiltrate. The low permeability restructured surface would continue off the pad and into the channel. Final grading would ensure that all runoff from the west side of the heap is directed efficiently to the reshaped Powers Gulch diversion channel, which would remain as a permanent structure after closure. Runoff from the east side of the heap would be conveyed via a diversion ditch to Powers Gulch. Riprap would be placed as needed to prevent scour/ undercutting of the channel and heap. Restructuring would promote runoff of rainwater. Possible methods include:

- Various types of soil compaction of the heap surface
and/or
- The use of sealants, such as clay or lime, to reduce surface permeability
and/or



- The establishment of an artificial hard pan on the surface of the heap

The last steps in the process would be to conduct final grading and establish vegetation on the heap. Approximately 3 to 4 million tons of mine rock would be required to construct the soil root zone layer on the reshaped heap over an area of approximately 300 acres. Mine rock from any or all three of the rock disposal areas would be used, depending on which material would be the most suitable. The removal of this relatively small volume of material would not noticeably reduce the size of the rock dumps, either in area or height. All salvaged topsoil would be applied on the surfaces of the pad, tilled, and seeded. Vegetation would then be established for erosion control, particularly for evapotranspiration of rainwater that does not run off. Seed Mix L (*Table 2-12*) is proposed for the leach pad.

The reclaimed leach pad is designed to function as an isolated unit. The pad would be sealed from below by a synthetic liner. The pad closure is designed to promote rainfall runoff (over 75 percent) by heap-surface soil sealing, and to use evapotranspiration from the vegetation to prevent the remaining water from entering the heap. The ground water that could occur under the heap would continue to migrate through the spine drain system located under the pad liner. Surface water generated in the small basin in Powers Gulch above the leach pad would be directed around the unit into the permanent diversion channel. No discharges from the unit are expected to occur since there would be no new infiltration to displace pore water out of the heap (Carlota 1994a).

During the life of the mining operation, laboratory, pilot, and full-scale testing would be conducted for all aspects of heap closure prior to actual closure. The north pad would be leached out several years prior to mine closure and would allow for heap closure and reclamation alternatives to be tested at full scale prior to actual closure of the main pad (Carlota 1994b).

New heap closure techniques may be developed over the life of the project as a result of research by Carlota and others working in the mining field. Potential heap reclamation techniques include using high-pH solutions (lime), rinsing, and artificial wetlands. As such techniques are developed, they would be exam-

ined for applicability to augment or replace the current heap closure and reclamation approach.

Other components of the proposed leach pad closure include conducting the final grading of the Powers Gulch diversion channel, removing equipment such as pumps and pipes, and revegetating leach pad areas not originally under leach (Carlota 1994a). All equipment used to operate the pad would be removed, as well as support structures such as power lines. A free-draining topography would be restored to the lower edges of the leach pad using suitable fill materials.

The PLS ponds are internal to the leach pad and would be closed as described for the pad. The other ponds associated with the leach pad are the raffinate pond and the plant PLS/SX pond. During mine closure, the raffinate pond and the plant PLS/SX pond would be emptied. The pumping and piping systems associated with circulating raffinate would be removed. The pond liners, and any slime and residual materials remaining in the ponds, would be excavated and placed on the leach pad (Carlota 1995a). The ponds would be covered by material from the sides of the leach pad and/or the Cactus Southwest mine rock area when it is recontoured. The surfaces would be seeded with an approved mixture to stabilize the site. The postclosure topography of the heap-leach pad, diversion tie-in, and ponds is shown in *Figure 2-13*. Performance monitoring of the heap system would continue until it is reasonably demonstrated that no leakage is occurring and that the potential no longer exists to degrade the waters of the state. Monitoring well samples would be collected quarterly with results catalogued and reported in a timely manner. The same water quality parameters analyzed from the monitor wells during operations would be analyzed during closure.

Pinto Creek and Powers Gulch Diversion Channels

The Pinto Creek and Powers Gulch diversions are designed to be left in place at the end of the life of the project. The need for additional work on these channels would be evaluated and undertaken before mine closure such that the diversions function in perpetuity. The leach pad reclamation configuration of

an impermeable layer and soil zone would be continued off the pad into the Powers Gulch diversion area. During reclamation, the open wedge between the outside edge of the heap and the Powers Gulch diversion would be filled in, recontoured, and sealed, if necessary, to prevent infiltration and to provide a wider floodplain along the diversion to accommodate large storm runoff events following closure.

Stormwater Control System

Stormwater control structures would be reclaimed or left in place as directed by the Forest Service or by a permitting agency (EPA, ADEQ). If reclamation is directed, channels, ponds, and sediment traps would be recontoured and revegetated. Certain portions of strategic diversion ditches may require additional channel protective work, such as gabions or boulder reinforcement. These areas would be identified and remediated prior to the end of the project life.

Structures

All equipment would be removed. No chemical or electrical hazards would remain after closure. All buildings and other facilities would be dismantled and removed from the site or buried. Foundations would either be removed and buried elsewhere on the site or buried in place. Facilities areas would be recontoured to create a natural appearance and prevent erosion. Disturbed areas would be revegetated with Seed Mix L.

Roads, Conveyor Routes, and Yards

Roads, with the exception of those in the pit and those designated for future use by the Forest Service, would be reclaimed. Road and conveyor route surfaces selected by the Forest Service for reclamation would be ripped and seeded, and downhill fill or slopecast materials would be broadcast seeded at higher rates than used in the leach pad or mine rock disposal areas. Water bars or other sediment control devices would be constructed as needed to minimize erosion, and the road and fill surfaces would be reseeded. Culverts and drainage structures would be removed or left in place, as directed by the Forest Service. The natural drainage patterns would be reestablished to the degree possible.

Reclamation Bonding

A reclamation bond and a financial assurance mechanism would be filed with the Forest Service and the Arizona State Mine Inspector's Office, respectively. The Arizona State Mine Inspector's office has authority (Arizona Mined Land Reclamation Statutes) to require a financial assurance mechanism on specified lands other than those administered by the Forest Service. Supplemental bonding or financial assurance may also be required by state and federal agencies other than those listed above.

On lands administered by the Forest Service, the reclamation bond amount would be sufficient enough to cover the full cost of reclamation for all facets and components of the proposed project. In determining the amount of the bond, consideration would be given to the estimated cost of stabilizing, rehabilitating, reclaiming, and conducting monitoring in the area of operations.

2.2 Project Alternatives

Mine operations are composed of a number of operational components, and there are alternate means of accomplishing most components. In many EISs, a number of variations of operational components are linked together to form project alternatives that are then analyzed. For this EIS, the Forest Supervisor of the Tonto National Forest (the officer responsible for making a decision with regard to the plan of operations) asked that each alternate component be treated as a project alternative in order to better display the range of differences and to allow more flexibility in selecting an agency preferred alternative.

Project alternatives were selected for analysis in the EIS based on specific criteria:

- Public or agency issue or concern
- Ability to meet project purpose and need
- Technical or economic feasibility
- Potential environmental advantage over the proposed action

Project alternatives were also developed and evaluated relative to the COE and EPA requirements for compliance with Section 404 of the CWA. The alternatives are identified in Section 2.2.1, Alternatives Considered in Detail; Section 2.2.2, Alternatives Eliminated from Detailed Consideration; and Appendix A, Clean Water Act Section 404(b)(1) Alternatives Analysis.

2.2.1 Alternatives Considered in Detail

The alternatives analyzed in the EIS are described in the following sections. Carlota would construct, operate, and reclaim each alternative project component in the same manner as the respective component of the proposed action unless otherwise indicated. Alternative components may be integrated into the agency preferred alternative.

2.2.1.1 Mine Rock Disposal Alternatives

The environmental impacts of the three mine rock disposal alternatives listed below were analyzed in the EIS. These alternatives were developed in an attempt to locate disposal areas on previously disturbed and/or private lands or to reduce the size of the disturbance area.

- Alternative mine rock disposal sites
- Additional backfill of the Carlota/Cactus pit
- Additional backfill of the Eder South pit

Alternative Mine Rock Disposal Sites

Two additional sites would be available for the disposal of mine rock from the Carlota/Cactus pit; these sites are located northeast of the Carlota/Cactus pit and are shown in *Figure 2-14*. The capacity, area, and elevation of these sites based on angle of repose slopes are indicated in *Table 2-13*. With the selection of this alternative, Carlota could use one or both of these sites for mine rock disposal.

These sites would provide mine rock capacity of approximately 7.6 million tons and would disturb approximately 44 acres.

The Cactus South mine rock disposal area would be located directly east of the southeast end of the Carlota/Cactus pit. It would be placed in a narrow

drainage that runs east-west from the base of Pinto Valley's Cottonwood tailings impoundment toward Pinto Creek. This area would be located on National Forest land. The disposal area, as estimated, would be approximately 200 feet high, with a top elevation of 3,950 ft-amsl, and the footprint would cover approximately 22 acres. Because BHP Copper operates a well field at the base of the Cottonwood tailings impoundment and access must be maintained to this facility, the footprint for this alternative disposal site does not extend to the toe of the tailings.

This site has not been identified as Carlota's proposed action for two reasons: (1) the relatively limited storage volume, although it would be advantageous to have a short truck haul for placing mine rock in this area; and (2) the possible mixing of surface and ground water discharges from the Cottonwood tailings pond with any runoff from the Carlota mine rock disposal area in this area would make it difficult to determine the source of any potential contaminants.

The Cactus Central mine rock disposal area would also be located in the vicinity of the east end of the Carlota/Cactus pit at the head of a small drainage above the pit on private property. This area also has a relatively small volume and covers approximately 22 acres. It is a shallow disposal site, with an estimated top elevation of 3,800 to 3,850 ft-amsl. Use of this area would afford short truck hauls from the adjacent portion of the Carlota/Cactus pit.

Additional Backfill of the Carlota/Cactus Pit

Carlota currently proposes to mine the Carlota/Cactus pit during Phases 1 through 5 in project Years 1 through 13. The proposed action would include the placement of backfill material during Years 9 through 13 in the eastern portion of the mined-out pit along the western side of the Pinto Creek diversion channel to an elevation of 3,600 ft-amsl. However, the sequence of mining, as well as the configuration of the pit, would preclude the placement of additional backfill during mining in other areas of the Carlota/Cactus pit. Therefore, additional backfill of the remainder of the Carlota/Cactus pit would involve removing mine rock from disposal areas after Year 13 and transporting the rock back to the mined out Carlota/Cactus pit.

Table 2-13. Alternative Mine Rock Disposal Sites

Site	Capacity (tons)	Area (acres)	Planned Elevation (ft-amsl)
Cactus South	4.6 million	22	3,950
Cactus Central	3.0 million	22	3,800 - 3,850
TOTAL	7.6 million	44	N/A

This backfill alternative would be completed after mining of the Carlota/Cactus pit and would result in backfilling the remaining mined-out area to the premining elevation of Pinto Creek (approximately 3,520 ft-amsl elevation). The purposes of the additional backfilling would be to (1) increase the stability of the pit by reducing the exposed heights, (2) provide a means to partially reclaim the pit area, and (3) address future public safety concerns associated with leaving an open pit and highwall (crest) on public land, (4) increase the reclaimed areas associated with mine rock disposal, (5) improve drainage control, and (6) decrease visual impacts.

To accurately describe this alternative, the Forest Service reviewed the rock tonnages, haul rates, and costs provided by Carlota (1994b) and made minor modifications to selected values to remain consistent with similar values presented in the Proposed Action, Section 2.1. In this alternative, an additional 88 million tons of mine rock would be required to backfill the Carlota/Cactus pit to the existing elevation of Pinto Creek (3,520 ft-amsl) through the pit area (*Figure 2-15*). The additional 88 million tons required to backfill the remaining pit would be hauled from the Main mine rock disposal area to the pit.

This alternative would change the proposed reclamation configuration of the Carlota/Cactus pit by raising the bottom of the pit from a 2,840-ft-amsl elevation to a 3,520-ft-amsl elevation (*Table 2-14*). As a result, the reclaimable area of the Carlota/ Cactus pit would increase from approximately 84 to 194 acres, including buffer areas. The remaining acres would be pit slopes and benches that were not considered reasonably suitable for revegetation.

Reclamation would entail grading the backfilled pit surface, placing topsoil on the pit surface, seeding

and planting, and performing erosion control measures.

The final elevation of the Main mine rock disposal area would be reduced from approximately 4,160 ft-amsl (Carlota 1994a) to 3,850 ft-amsl (with natural terrain similar to the premining configuration exposed over a large portion of the site). Approximately 24 million tons (21 percent) of the mine rock originally placed in the Main mine rock disposal area would remain following this backfilling alternative. The portion of the Main mine rock area to be reclaimed would increase from approximately 134 acres to 177 acres (*Table 2-14*). *Table 2-14* summarizes the changes to the pits and mine rock disposal areas associated with this alternative in terms of areas disturbed, areas reclaimed, and elevations. This alternative would address possible pit wall instability, public safety concerns associated with exposed highwalls, drainage control, visual effects, and site reclamation.

If the same loading and hauling equipment proposed for the project were used to complete the backfilling at a nominal rate of 26 million tons per year, approximately 190 people would be required for approximately 3 to 4 additional years to implement the Carlota/Cactus pit backfill alternative. The estimated additional cost for this alternative is \$50 to \$52 million.

Additional Backfill of the Eder South Pit

This alternative would involve backfilling the Eder South pit with a total of approximately 5 million tons of mine rock from the Eder mine rock disposal area. Backfilling would modify the final pit configuration to create a flat to sloping backfill surface; the highwall would be covered to 4,300 ft-amsl. Reclamation would involve replacing topsoil, seeding, and planting to establish a permanent vegetative community

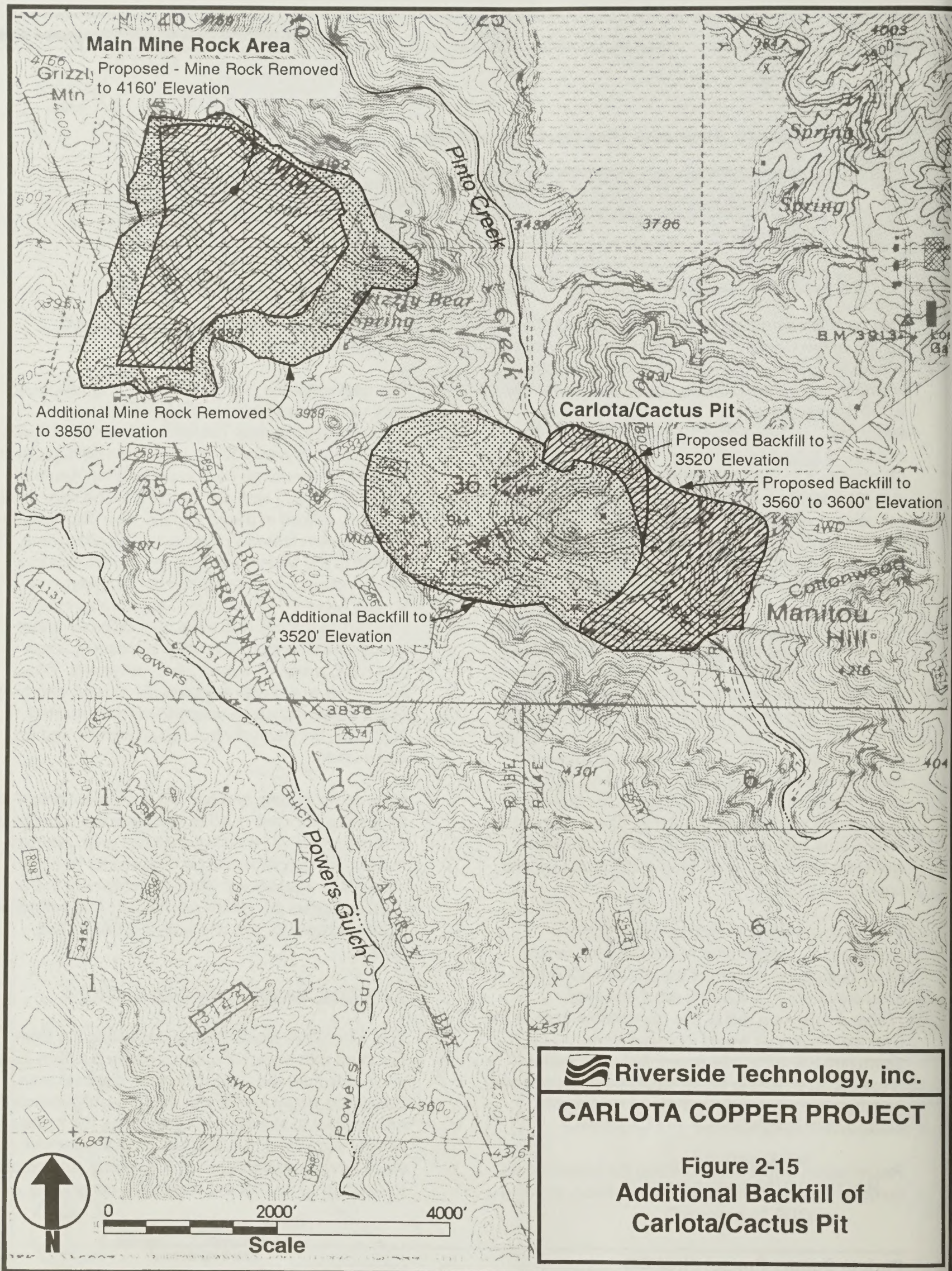


Table 2-14. Pit Backfill Alternatives

	Proposed Action	Additional Carlota/Cactus Pit Backfill	Additional Backfill of Eder South Pit
Carlota/Cactus Pit:			
Disturbed Area (acres)	320	320	No Change
Reclaimed Area (acres)	84	194	No Change
Pit Bottom Elevation (ft-amsl)	2,840	3,520	No Change
Main Mine Rock Area:			
Disturbed Area (acres)	227	227	No Change
Reclaimed Area (acres)	134	177	No Change
Top Elevation (ft-amsl)	4,160	3,850	No Change
Cactus Southwest Mine Rock Area:			
Disturbed Area (acres)	100	No Change	No Change
Reclaimed Area (acres)	71	No Change	No Change
Top Elevation (ft-amsl)	4,360	No Change	No Change
Eder North Pit:			
Disturbed Area (acres)	34	No Change	No Change
Reclaimed Area (acres)	17	No Change	No Change
Pit Bottom Elevation (ft-amsl)	3,960 - 4,000	No Change	No Change
Highwall Height (feet)	480	No Change	No Change
Eder South Pit:			
Disturbed Area (acres)	81	No Change	81
Reclaimed Area (acres)	26	No Change	42
Pit Bottom Elevation (ft-amsl)	4,150 - 4,230	No Change	4,300
Highwall Height (feet)	710	No Change	570
Eder Mine Rock Area:			
Disturbed Area (acres)	73	No Change	73
Reclaimed Area (acres)	40	No Change	73
Top Elevation (ft-amsl)	4,240	No Change	No Change ¹

¹ All mine rock would be removed. The area would be reclaimed to approximate original contours.

similar to the surrounding area. The small pit proposed to be mined north of the Eder South pit would not be backfilled; excavation would not extend below the existing topography on the east side. Removing approximately 5 million tons of mine rock from the Eder mine rock disposal area to the Eder South pit and removing approximately 2.9 million tons to the leach pad as a 4-foot cap would remove all of the mine rock placed in the Eder Mine rock disposal area. The disturbed area for the Eder mine rock disposal area would be reclaimed with this alternative. The configuration of the Eder South pit and the Eder mine rock disposal area for this alternative is shown in *Figure 2-16*. The highwall height along the western side of each of the pits

would be reduced from 710 feet to 570 feet for the Eder South pit.

Backfilling the Eder South pit would result in an increase in reclaimed area (*Table 2-14*) by creating more flat or sloping area. The reclaimed area for the Eder South pit would increase from 26 acres to 42 acres. The remaining portions of the pit would comprise pit slopes and benches that are not considered reasonably suitable for revegetation. The reclaimed area for the Eder mine rock disposal area would increase from approximately 40 acres to 73 acres. The continued placement of backfill in the Eder South pit after the cessation of mining would require a fleet of trucks and excavators and associated support

equipment. This fleet has a capacity of approximately 26 million tons per year for the proposed action (*Table 2-3*). It would require approximately 2.3 months at this production rate to complete backfilling of the Eder South pit. The estimated number of personnel required for this fleet is 190. The estimated cost for this alternative is \$2.6 million.

Eder Mine Rock Disposal Alternative

The implementation of the Eder side-hill leach pad alternative would necessitate relocating the Eder mine rock disposal area. This alternative mine rock disposal site is discussed in Section 2.2.1.2, Leach Pad Alternative, and is analyzed with the Eder side-hill leach pad alternative in Chapter 3.

2.2.1.2 Eder Side-Hill Leach Pad Alternative

The Forest Service initially considered several additional alternative leach pad sites. Descriptions of these sites and the reasons for their elimination from detailed consideration are discussed in Section 2.2.2.3.

This alternative was developed in an attempt to minimize the impacts associated with the disturbance of the Powers Gulch drainage, including waters of the U.S. This alternative leach pad location would place the pad outside of the main channel of Powers Gulch to meet CWA Section 404 objectives. This configuration would have the capacity to store a maximum of approximately 75 million tons of ore (25 million tons less than the valley fill option), with 46 million tons stored on the west side of Powers Gulch between the Eder pits and 29 million tons stored on the east side (*Figure 2-17*). The area of disturbance for the leach pad would be approximately 458 acres, which would all be reclaimed during mine closure. This alternative would result in relocating the Eder mine rock disposal area and constructing toe berms along both sides of Powers Gulch to stabilize the heap and accommodate internal solution storage.

The Eder mine rock disposal area would be relocated to an area immediately south of the Eder South pit (*Figure 2-17*); this location was selected based on capacity and haulage distance. The alternative mine rock disposal area design would have a capacity of approximately 9 million tons, which would be adequate to hold the amount of material left over after

backfilling the Eder South pit. The mine rock disposal area would disturb approximately 37 acres, approximately 20 acres of which would be reclaimed. This alternative would require some modification to the in-pit access to the Eder South pit so that the mine rock disposal area's access point would be available throughout the mining of the Eder pits. In addition, the reclaimed material for backfilling the Eder North pit would be hauled through the Eder South pit. This would require modification to the current Eder pit design to maintain access, and would either add waste stripping or reduce the amount of ore produced from the Eder pits.

As with the valley fill option (proposed action), the side-hill alternative would incorporate solution storage within the pad itself and would use a conveyor/truck-stacking scenario to load the pad. Because of the expansive nature of this option and the fact that the pad crosses a number of small hillside drainages to Powers Gulch, process solutions would be collected in six different PLS ponds behind three embankments for subsequent recycling to the plant site (*Figure 2-17*).

Slope stability in this alternative would require relatively large toe berms, in excess of 50 feet, to generate marginally acceptable factors of safety and accommodate internal solution storage. The minimum factors of safety for this scenario were 1.3 and 1.0 for static and pseudostatic, respectively (Carlota 1994b), which are less than the minimum factors of safety generally acceptable for dam design. The lower factors of safety are largely a result of the lack of buttressing at the toe of the pad.

Large areas on both sides of Powers Gulch would be used for ore storage. The pad configuration results in a maximum heap-leach pad elevation of 4,475 ft-amsl, roughly 275 feet higher than the valley fill option (*Figure 2-17*). On the east side of Powers Gulch, the pad would be placed up the side of the proposed Main mine rock disposal area in the north pad area, approximately 200 feet (slope distance), and would expand the pad on the east side from the proposed plant site location south approximately 800 feet (slope distance). *Table 2-15* summarizes other pertinent physical characteristics of this alternative. Appendix A, Clean Water A Section 404(b)(1) Alternatives Analysis, contains a discussion of this alternative relative to the Section 404 Permit.

2.2.1.3 Powers Gulch Diversion Embankment

This alternative, as originally described in the Draft EIS, has been modified and included as the inlet control structure component of the proposed action, (see Section 2.1.3.3 - Powers Gulch Inlet Control Structure and Diversion Channel). Therefore, no further analysis or discussion of this alternative is included in this Final EIS.

2.2.1.4 Water Supply Alternatives

Additional water supply alternatives were initially considered but were subsequently eliminated for the reasons discussed in Section 2.2.2.5.

Powers Gulch Diversion Embankment, Water Supply Wells, and Dewatering Wells

This alternative, as originally described in the Draft EIS, is no longer feasible as a stand-alone alternative since the diversion embankment has been modified and included as the inlet control structure component of the proposed action (see Section 2.1.3.3 - Powers Gulch Inlet Control Structure and Diversion Channel). The inlet control structure would not retain water and therefore would not be considered a water supply alternative. Therefore, no further analysis or discussion of this water supply alternative is included in this Final EIS.

Low Quality Water, Water Supply Wells, and Dewatering Wells

The alternative to use low-quality water considers using water resources that may have been degraded by previous mining activities in the region. Low-quality water could be used to supply up to 59 percent of the project's water needs during dry periods of the year. This water could be used to replenish water used in the leach operations. During dry periods of the year, the proposed project would require approximately 350 gpm of fresh water for non-leach plant uses, including boiler feed, dust control, washdown, and potable supply; the remaining 500 gpm required for leach loss makeup could be supplied from secondary sources, such as low-quality water from outside the project area.

The proposed and alternative water supplies would be used as follows:

- Well field - EW operations; make-up water; road watering; potable uses; leaching, if necessary
- Pit dewatering - road watering, leaching, potable uses
- Low-quality water - leaching; road watering, if appropriate

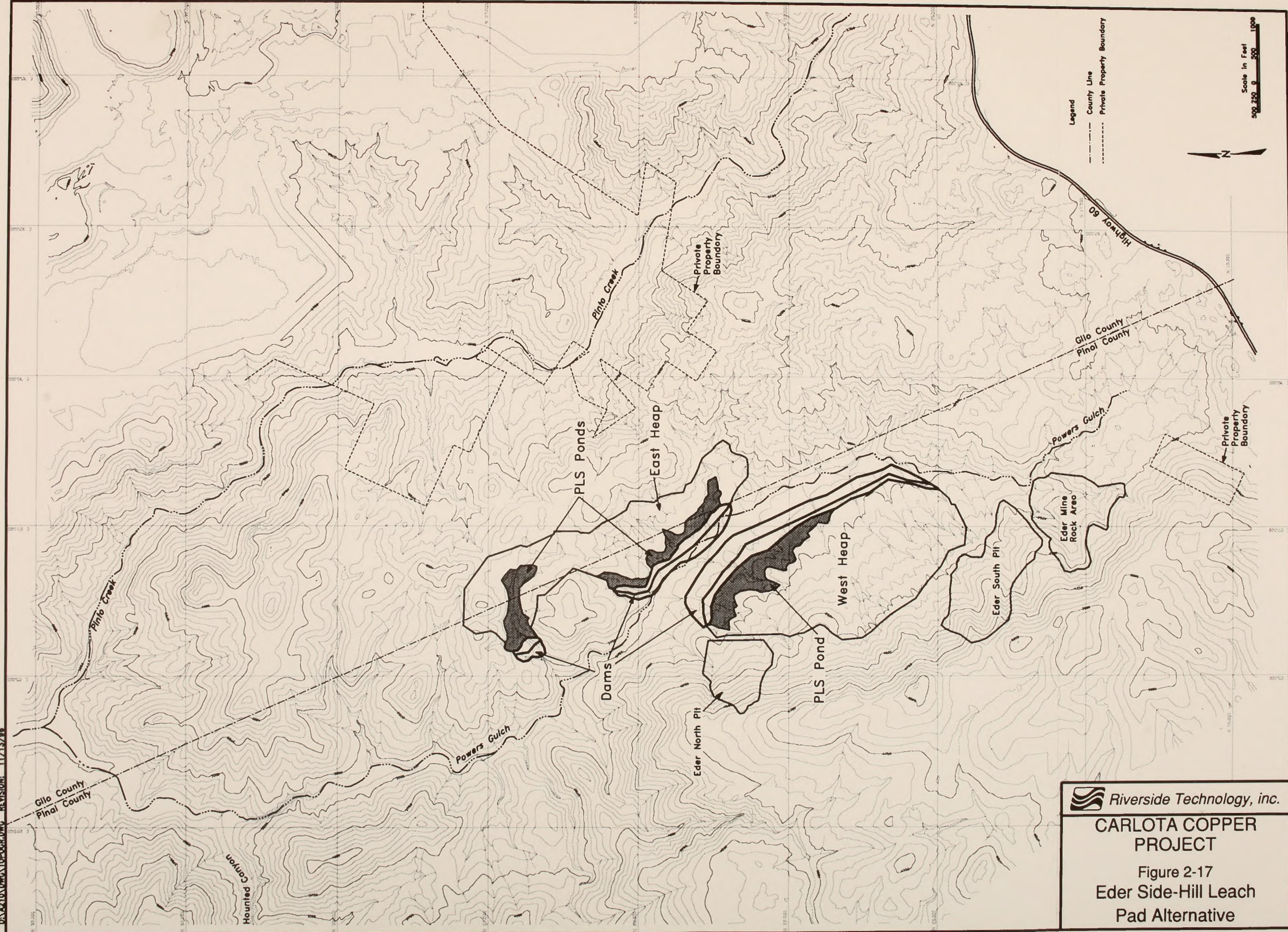
The EIS evaluated in detail four possible sources of low-quality water. The quality of the water and the pipeline routes would be similar for the water sources evaluated. It is possible that other water sources may be identified in the future and that pipelines from these sources could be tied into the primary pipeline route identified in this EIS.


Pinal Creek Water. Low-quality water may be available from a section of Pinal Creek that is located approximately 12 miles northeast of the Carlota Copper Project. Three mining companies (Cyprus Miami Mining Company, BHP Copper Company, and Inspiration Consolidated Copper Company) comprise the Pinal Creek Remediation Group. This group is responsible for remediating degraded ground water quality in the Pinal Creek drainage; a site on the State of Arizona Water Quality Assurance Revolving Fund Priority List. This list is the State's equivalent to the federal superfund, which also funds cleanup projects resulting from the release or threatened release of hazardous substances into the environment.

The Pinal Creek Remediation Group extracts ground water from the Pinal Creek drainage, below the confluence of Tinhorn Wash, and transports it by pipeline approximately 4 to 5 miles to BHP Copper's abandoned Diamond H pit. A steel pipeline owned by BHP Copper then carries partially treated water approximately 10 miles across BLM, Forest Service, and private lands to the Cottonwood tailings pond at BHP Copper's Pinto Valley Mine.

The Pinal Creek Remediation Group has indicated it potentially could supply Carlota with water that is not

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Figure 2-17
Eder Side-Hill Leach
Pad Alternative

Table 2-15. Physical Characteristics of Proposed Action and Eder Side-Hill Alternative

	Proposed Action	Eder Side-Hill Alternative
Length of Powers Gulch Realignment (feet)	6,700	2,100
Solution Retention Embankment Length (feet)	1,350	14,640
Solution Retention Embankment Area (acres)	7	79
Leach Pad Disturbance Area, Including Diversion (acres)	313	458
Eder Mine Rock Disposal Area Disturbance (acres)	73	37
Basin Area (area under ore) (acres)	270	379
Maximum Heap Elevation (ft-amsl)	4,200	4,475
Required Solution Storage Capacity (million gallons)	104	214
Reclaimed Area (acres)	283	458
Capital Cost (\$ million)	\$9.8	\$15.4

required for the Cyprus Miami or BHP Copper operations. If this were to occur, Carlota would construct and operate a pipeline along BHP Copper's existing pipeline right-of-way (*Figure 2-18*) to carry untreated Pinal Creek drainage water from the Diamond H pit, to the Carlota raffinate pond at the SX/EW plant area, a total distance of approximately 9-10 miles. After divergence from the BHP Copper pipeline right-of-way, Carlota's pipeline would follow the power line route around the north side of the Carlota/Cactus pit to the raffinate pond, a distance of approximately 3 additional miles.

The quality of the untreated Pinal Creek water is discussed in Section 3.3, Water Resources. Because of the low pH of the water, the facilities would be constructed of HDPE-lined steel pipe and acid-resistant pumps. The pipe would be approximately 8 inches in diameter to supply a flow rate of approximately 1,000 gpm.

The availability of water is uncertain at this time because the Pinal Creek Remediation Group cannot currently verify that it has the legal right to enter into a contract with Carlota.

BHP Copper's Copper Cities Pit Water. Low-quality water may be available from BHP Copper's Copper Cities pit located approximately 1 mile east of the

Diamond H pit (see *Figure 2-18*). This pit collects water from runoff, pit inflow, and BHP Copper's Number 2 tailings facility. The excess water, beyond BHP Copper's requirements, may be available for Carlota's use. Carlota would construct and operate an HDPE-lined steel pipeline (8- to 12-inch diameter) to transport untreated water from the Copper Cities pit to Carlota's raffinate pond, a distance of approximately 14 miles. The pipeline route would be similar to the pipeline route for the Pinal Creek water (see *Figure 2-18*); the pipeline route would follow the right-of-way for BHP Copper's existing pipeline from the Diamond H pit. It is also possible that BHP Copper and Carlota may jointly construct and operate this pipeline to provide water to both the Carlota Copper Project and BHP Copper's Pinto Valley Mine.

As with the Pinal Creek water, this water would have a low pH and high concentrations of copper and iron (see Section 3.3, Water Resources, for a discussion of the quality of this water).

The excess water, if any, that may be available from the Copper Cities pit is recycled water currently recovered from a tailings leaching project operated by BHP Copper. The tailings leaching project is expected to be completed in approximately Year 2000, and the availability of this potential water source may be uncertain after the leaching project is concluded.

Cyprus' Oxhide Pit Water. Low-quality water may be available from Cyprus Miami Mining Company's Oxhide pit located to the southeast of BHP Copper's Cottonwood tailings facility and approximately 4.5 miles east of the Carlota Copper Project (see *Figure 2-18*). It is likely that less water would be available from this source than either of the two sources described previously; however, the Oxhide pit water could be used to supplement low-quality water from another source. If available for Carlota's use, Carlota would construct a pipeline spur from the Oxhide pit to the pipeline from either Pinal Creek or the Copper Cities pit.

This water would have a low pH and high concentrations of copper and iron (see Section 3.3, Water Resources, for a discussion of the quality of this water). This pipeline would be constructed of HDPE-lined steel and would be 8 to 12 inches in diameter.

The Oxhide pit is used by Cyprus' operations at various times for storing water from pit dewatering, storing raffinate solution, and collecting surface runoff. The water from the Oxhide pit is used by Cyprus as required for its operations. As such, the availability of the Oxhide pit water for the Carlota Copper Project is uncertain at this time.

BHP Copper's Cottonwood Storage Pond. Low-quality water may be available from a storage pond located in the northeast corner of the Cottonwood tailings facility at the Pinto Valley Mine. A pump barge would be installed in the Cottonwood pond, and Carlota would construct a pipeline from the Cottonwood pond to Carlota's raffinate pond (*Figure 2-18*). The pipeline would be 4 to 6 inches in diameter and would be either HDPE, steel, or a combination of the two, depending on pressure requirements along the route. As shown in the figure, the pipeline would be routed through the Pinto Valley facilities along the west side of the Cottonwood tailings pond to the vicinity of the main entrance to the Carlota Copper Project. The pipeline would cross under the Pinto Valley Mine road and follow the Carlota main access road along the north side of the Carlota/Cactus pit. The project power line and other pipelines would be located within a utility corridor along the access road for ease of maintenance; the secondary water line would also be located in this corridor. The pipeline would cross Pinto Creek on the north side of the pit and follow the route of the overland conveyor up to

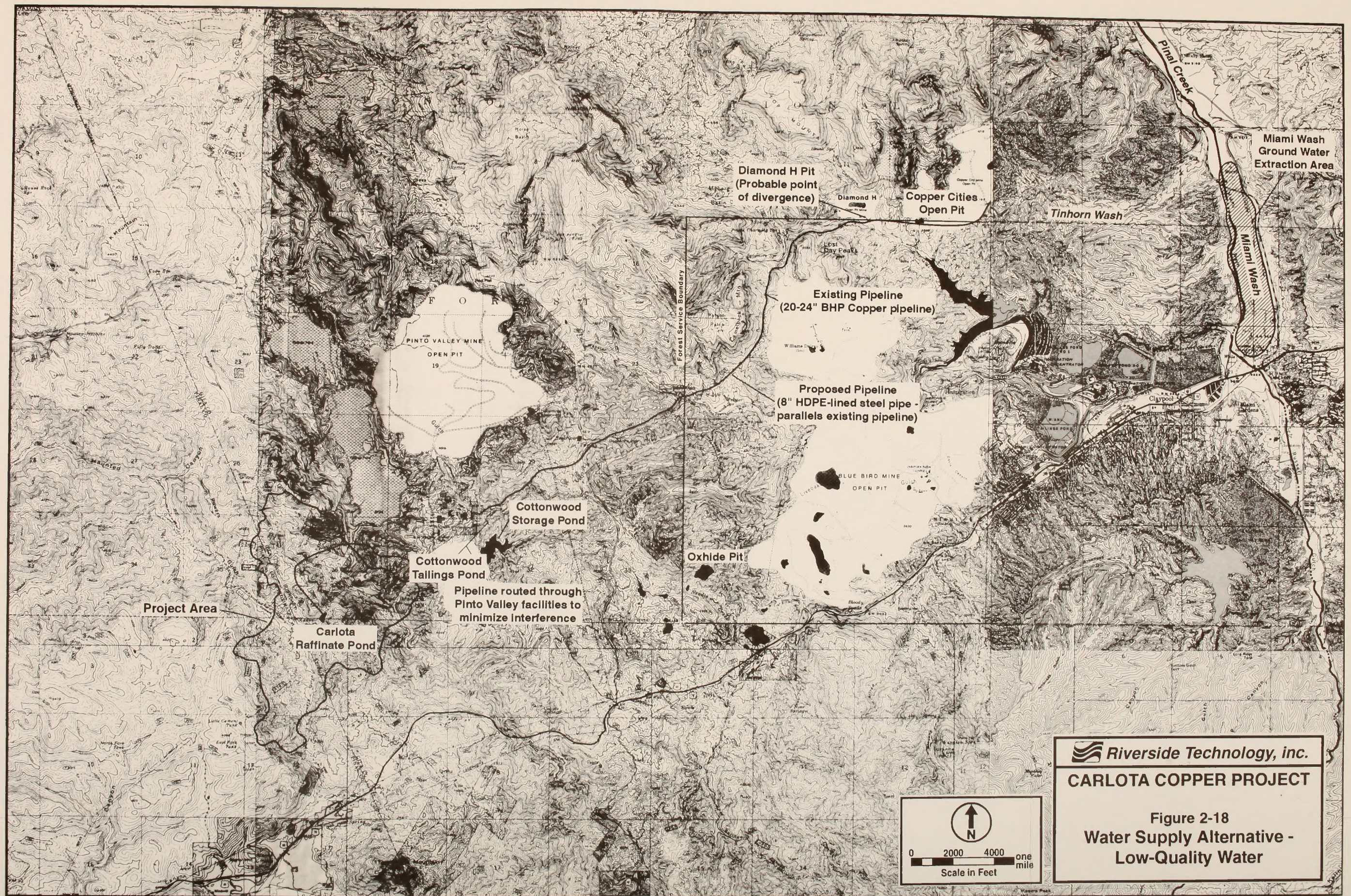
the ridge that divides Pinto Creek from Powers Gulch. From there, the pipeline would run along the ridge, following several other pipelines, to the raffinate pond.

The water in this pond comprises water from both Cyprus Miami Mining Company's operations and BHP Copper's operations, including water originating from the Pinal Creek remediation site. Carlota has an agreement in principle with Cyprus and BHP Copper to purchase water from BHP Copper's Cottonwood storage pond (Carlota 1995b). The water agreement would provide up to 1,000 gpm, on a continuous basis, contingent upon its availability from the storage pond. BHP Copper and Cyprus would have the option of terminating or suspending delivery if (1) BHP and Cyprus require some or all of the water to maintain their operations, (2) water discharge by Carlota was found to exceed ADEQ's water quality limits, (3) the Gila River adjudication or other judicial proceeding precluded supplying water to Carlota, or (4) ADEQ requires a remedy that would preclude supplying the water to Carlota.

The water that would be supplied from the Cottonwood storage facility is a calcium sulfate water with moderately high total dissolved solids (TDS) and a neutral pH. Sulfate and TDS concentrations are greater than their respective federal secondary maximum contaminant levels (MCLs). However, compared to the Pinal Creek, BHP Copper Cities Pit, and Cyprus Oxhide water sources, the Cottonwood tailings water generally has considerably lower dissolved metals concentrations. Based on the neutral pH and lower metals concentrations, water from the Cottonwood storage facility would be considered a higher quality water source than the other low-quality alternative water sources (see Section 3.3, Water Resources, for a more detailed description of the quality of this water).

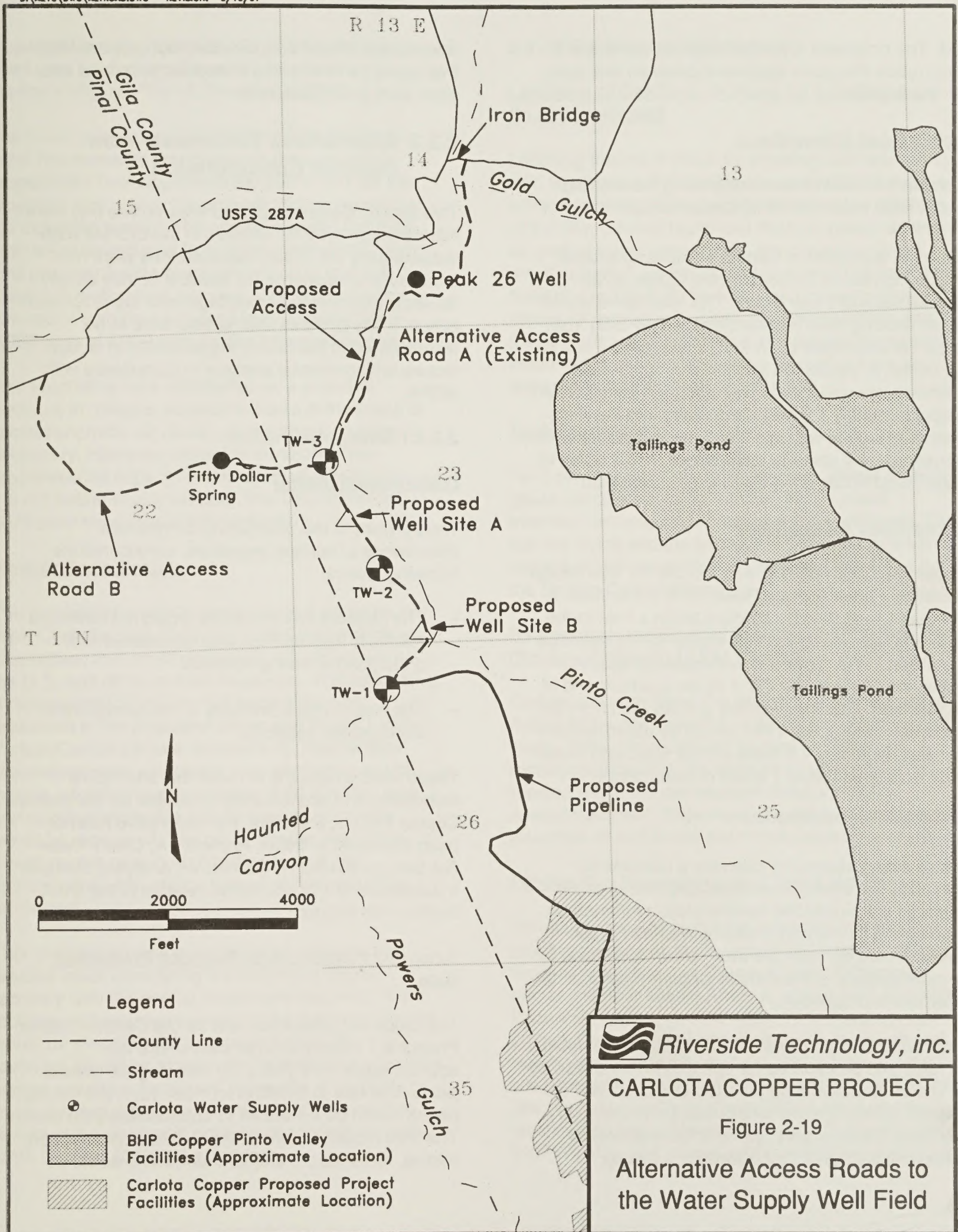
2.2.1.5 Alternative Water Supply Well Field Access Roads

Two alternative routes were evaluated for access from the north to the water supply well field (Carlota 1994c): Alternatives A and B (*Figure 2-19*). Like the proposed access road, the alternative routes would be single-lane with a drainage ditch and culverts, as required. Alternative A would ford the Pinto Creek stream channel at three locations. Alternative B would cross Pinto Creek via the Iron Bridge from east to



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Figure 2-18
Water Supply Alternative -
Low-Quality Water



west. The proposed route and Alternatives A and B would follow the same alignment between well sites TW-1 and TW-3.

Access Road Alternative A

Alternative A would involve upgrading the existing access road within the Pinto Creek floodplain.

This route is parallel to Carlota's proposed access route, which would be constructed higher up along the west bank of Pinto Creek. This alternative would use an existing road (Forest Service Trail 203) from Forest Service Road 287A to BHP Copper's Peak 26 well (which is located on private land) and would continue on to well TW-1. The total road length would be approximately 1.9 miles from entry into the Pinto Creek drainage to well site TW-1, and would result in approximately 4 acres of disturbance, 1 to 2 acres of which would occur in the Pinto Creek floodplain.

Access Road Alternative B

Access road alternative B would cross the Iron Bridge and follow Forest Service Road 287A to the west. A new road would then be constructed in a loop to the south and east along the Fifty Dollar Spring drainage to well site TW-3. Then it would follow the existing access road to well site TW-1 at the southern end of the well field. The length of this access road from the Iron Bridge to well site TW-1 would be approximately 3.8 miles, including 1.2 miles of new road, and would result in approximately 7 acres of disturbance.

2.2.1.6 No Action Alternative

The no action alternative provides a baseline for estimating the environmental consequences of the proposed action and the various project alternatives. By selecting the no action alternative, the Forest Service would not approve the Plan of Operations for the development of the Carlota Copper Project on the public lands in question.

Under federal regulations (36 *CFR* 228) that establish the rules and procedures for operations authorized by the United States mining laws (30 U.S.C. 21-54) on National Forest System lands open to mineral entry, the Forest Service does not have the authority to disapprove a Plan of Operations for a mining

operation provided the plan does not propose actions that would be in violation of applicable federal and state laws and regulations.

2.2.2 Alternatives Eliminated from Detailed Consideration

This section describes project alternatives that were initially considered for analysis in the EIS but were subsequently eliminated because they were not technically or economically feasible or they clearly lacked environmental advantage over the proposed action. If any of these alternatives were to be reconsidered in the future, implementation would require environmental analysis in compliance with NEPA.

2.2.2.1 Mining Alternatives

Underground Mining

The purpose of this alternative, to minimize disturbance of surface resources, considered the following factors:

- The project's low-grade ore would not cover the relatively high mining costs associated with underground mining methods.
- The near-surface ore body is not conducive to underground methods.

These factors combine to make this alternative technically and economically infeasible for the Carlota Copper Project; therefore, this alternative has not been evaluated in detail. Appendix A, Clean Water Act Section 404(b)(1) Alternatives Analysis, contains a discussion of this alternative relative to the CWA Section 404 Permit.

Extended Project Life at Reduced Production Rate

The proposed production rate for the Carlota Copper Project is 7 million tons per year of ore for approximately 14.5 years. By reducing the annual production rate to 5 million tons per year, the mining period would be increased to approximately 20 years. The total project life, including facilities construction, mining, reclamation, and abandonment, would be

extended from approximately 21 years to 23 years. The lower production rate would be similar to Carlota's original Plan of Operations (1992).

The lower production rate would reduce the equipment requirements and decrease the operation's employment from approximately 282 to 301 for the proposed action to approximately 222 personnel for the extended project. The annual material removal rate would be reduced from approximately 24 million tons per year for the proposed action to approximately 19 million tons per year. The process plant flow rate would be decreased from approximately 6,000 gpm to 4,000 gpm for the extended project.

This alternative was considered as a potential measure to mitigate adverse impacts in the areas of socioeconomics, air quality, and water resources, if necessary. However, since the duration of the environmental impacts of this alternative is longer and it is not economically feasible, this alternative was eliminated from detailed consideration.

Smaller Scale Project

The purpose of a smaller-scale project would be to meet CWA Section 404(b)(1) guidelines to address alternatives that could reduce impacts to waters of the U.S. and other surface resources. This alternative is represented by mining the same Eder pits presented in the proposed action and Phase I of the Carlota/Cactus pit (see Appendix A). Two smaller alternatives were evaluated; one alternative would include a total mineable reserve of 40.3 million tons, and approximately 264 million pounds of copper would be recovered. The other smaller alternative would involve mining 80.8 million tons of ore; approximately 690 million tons of copper would be recovered.

This alternative was not considered economically feasible when comparing the volume of copper recovery with the capital investment required. The facilities and equipment required for a smaller project would be similar to the proposed project, but revenues would be significantly reduced because less copper would be recovered. Appendix A contains a more detailed discussion of this alternative and the results of the economic analysis in accordance with CWA Section 404(b)(1) guidelines.

2.2.2.2 Processing Alternatives

Leaching of Ore Body in Place by Injecting Acid (In situ Leaching)

Leaching the ore in place by injecting and recovering acid solutions is not feasible because of the near-surface location of the ore and the complex geology of the site. Several faults and fracture zones, as well as ground water resources in the ore zone, would result in lack of control of the solutions to be injected. Solutions would likely be lost, with no reasonable means of recovery. The risk of losing solutions and the degradation of adjacent surface and ground water resources make this alternative infeasible from an environmental perspective.

Tank Processing

Tank processing of ore is usually considered for high-grade ore deposits or for ore requiring special treatment techniques for recovering the minerals. The low ore grade and the quantity of ore to be processed make this technique impracticable and infeasible for the Carlota Copper Project.

Segregation and Special Treatment of Sulfide Ore (Encapsulation and Lime Buffer)

Carlota has completed the exploration and delineation drilling of the ore deposit to determine the nature and extent of the ore proposed for mining. Based on metallurgical testing, the amount of sulfide ores present within the ore deposits does not justify special treatment. Therefore, segregation and special treatment of sulfide ore are not considered applicable.

Off-Site Ore Processing (and Truck Hauling)

Off-site processing of the ore assumes that an existing processing facility would be used. Existing facilities are present at Cyprus Copper Company's operations near Miami, Arizona, and at BHP Copper's Pinto Valley Mine, located adjacent to the proposed project. Carlota's ore is primarily oxide in nature and would be processed by sulfuric acid leaching. An off-site processing facility would need to be similar to the one proposed by Carlota to include a lined pad for leaching the ore, raffinate pond(s), PLS pond(s), an SX/EW plant, and related support facilities, such as a

water supply, maintenance facilities, an office and administration building, and employee bathhouse facilities. It is unlikely that existing mines would have the capacity to accommodate the proposed volume of ore within their existing facilities, and expansions to their existing processing facilities would be required. Duplicate facilities, road improvements, additional trucks, additional employees, and associated support facilities would be required. As a result, the increased cost would make this alternative impracticable to consider. In addition, Carlota would not have control of the processing facility, and the Forest Service has no authority to require Carlota to use a competitor's facility.

Leach Solution Ponds Exterior to Leach Pad

The proposed project considered using PLS ponds located downgradient of the heap-leach pad to collect pregnant solution from the leaching process. Evaluation of this configuration was completed, including the following elements:

- Additional evaporation from pond surface and required makeup water
- Exposure of acid solution to wildlife
- Additional space for location of the ponds

The proposed project has been modified from the 1992 Plan of Operations to incorporate the PLS ponds within the heap-leach pad area. Pregnant solution would be stored in a double-lined area behind an embankment. This arrangement would address the need for minimizing evaporation and associated makeup water and the concern for protecting wildlife. There is no feasible location for PLS ponds downgradient of the proposed project leach pad because of the increased size of the leach pad. Therefore, this alternative has not been considered further.

2.2.2.3 Leach Pad Alternatives

The evaluation of alternative leach pad sites within and adjacent to the project area was conducted in two stages. First, sites were selected for consideration in the analysis based on the following engineering-related criteria:

- Minimum pad size of 100 acres
- Slopes predominantly less than 30 percent
- Soils suitable as subgrade
- No more than one or two watersheds per site

Once the alternative leach pad sites were selected for consideration, they were then analyzed for their potential to:

- Avoid waters of the U.S.
- Avoid or reduce impacts to habitat occupied by the threatened Arizona hedgehog cactus
- Minimize other environmental impacts

Several alternative leach pad sites were evaluated. Based on discussions with other federal agencies, it was suggested that five additional sites be evaluated in the Final EIS. Several of these additional sites were in or near the general areas that had been identified previously as alternative sites, while one was in an area not evaluated previously. In the following discussion, these five additional sites are identified as Sites 1 through 5 (*Figure 2-20*).

See Appendix A, Clean Water Act Section 404(b)(1) Alternatives Analysis, for a discussion of these alternatives relative to the Section 404(b)(1) guidelines.

Leach Pad and Main Mine Rock Disposal Area Switch (Site A)








This alternative would involve switching the leach pad and Main mine rock area locations described for the proposed action. The advantages of this alternative would be the same as those listed for the mine rock pad alternative; in addition, similar ore volumes would be maintained at each location with this alternative.

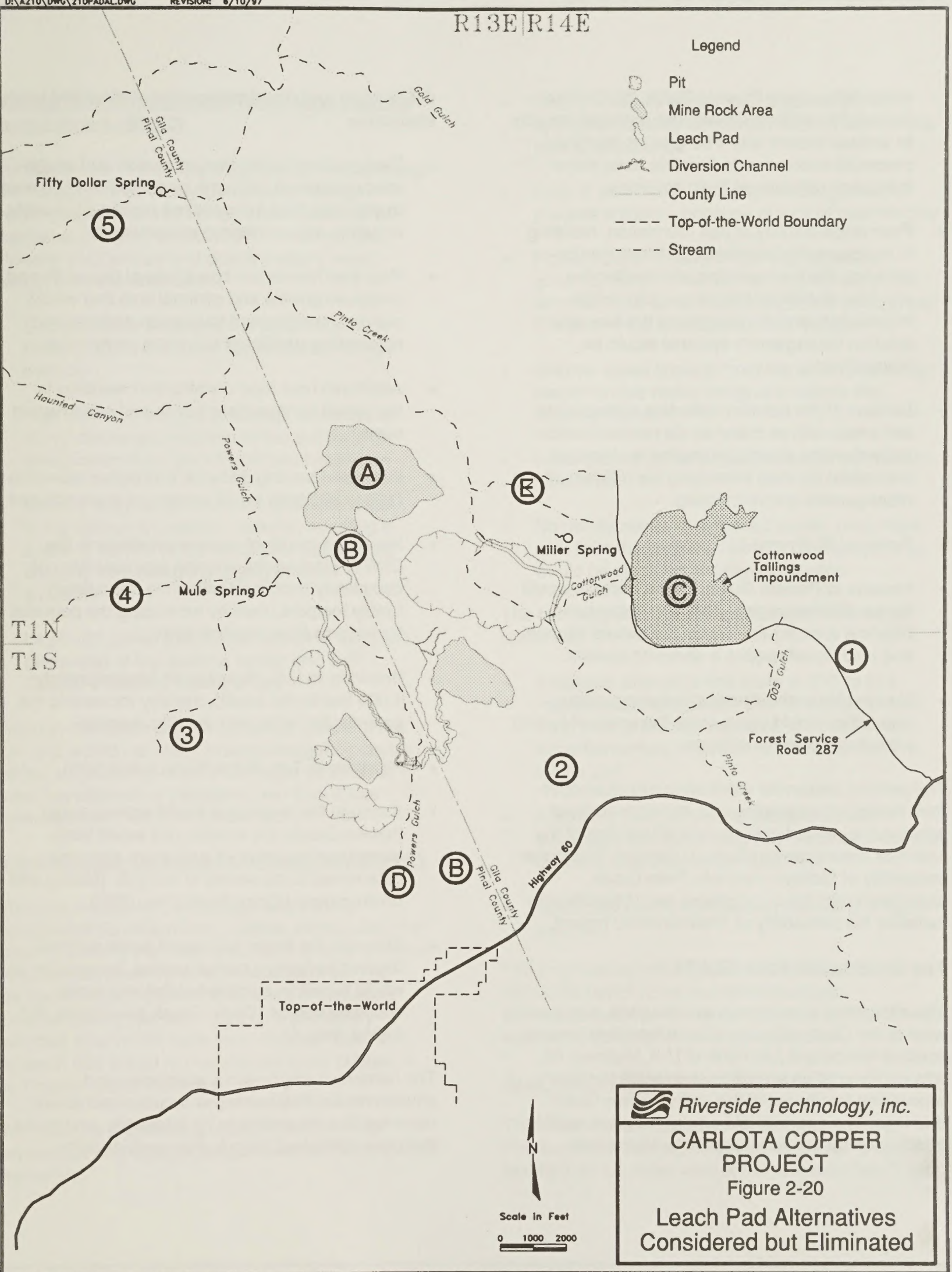

The following deficiencies and disadvantages were identified for switching the leach pad and mine rock disposal sites:

- Steep slopes (greater than 3H:1V for over 50 percent of the area), resulting in possible heap

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Legend

-  Pit
-  Mine Rock Area
-  Leach Pad
-  Diversion Channel
-  County Line
-  Top-of-the-World Boundary
-  Stream


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Figure 2-20

Leach Pad Alternatives Considered but Eliminated

slope failures into Powers Gulch, the Carlota/Cactus Pit, or Pinto Creek. The potential impacts to surface waters would be greater than the proposed action due to possible heap slope failures or releases of heap solutions.

- Poor slope stability of pad foundation, resulting in unacceptable interface conditions for constructing the liner systems and loading the ore. The stability of the heap could not be maintained, and the integrity of the liner and solution management systems would be jeopardized.
- Division of the solution collection systems into two areas with as many as six process ponds (based on the steep topography and natural watershed divides) increasing the difficulty of management and monitoring.
- Exposed PLS pond.
- Impacts to Powers Gulch. These impacts would not be eliminated since the Main mine rock disposal area would occupy the natural channel and also would require a diversion system.
- No benefits to the Arizona hedgehog cactus population would occur since the areas of habitat impacted would not change.

The primary reason for eliminating this alternative from further consideration was its failure to meet engineering-related criteria: over 50 percent of the area has slopes greater than 30 percent. The higher probability of facility failure into Pinto Creek associated with the steep slopes would significantly increase the probability of environmental impact.

Two Small Leach Pads (Site B)

The alternative of using two smaller pads, one located west of the Carlota/Cactus pit and the other located south of the pit and just north of U.S. Highway 60, was considered as an option to relocate the leach processing facility out of the main Powers Gulch drainage. The approximate size of the pads would be 219 and 83 acres, respectively. Numerous

deficiencies and disadvantages were identified for this alternative.

- Two geographically separate pads and associated equipment, with one pad less than 100 acres in size, resulting in increased construction costs, logistics, and monitoring requirements
- Poor pad foundation conditions at the south pad (exposed granite and minimal soil) that would require importing soil foundation material and conducting significant subgrade preparation
- Additional haul road construction resulting in increased surface disturbance and construction costs
- Increased hauling distance and higher elevation (100 to 200 feet) for 80 percent of the leach pad
- Increased length of solution pipelines to the SX/EW plant where solution pipelines are not completely contained within the heap-leach facility footprint, thereby increasing the potential for impacts from pipeline leaks
- Proximity to U.S. Highway 60 (approximately 1,000 feet to the south), thereby increasing the potential for noise and visibility impacts
- Proximity to Top-of-the-World subdivision
- Although the larger pad would entirely avoid Powers Gulch, the smaller pad would likely impact some portion of a tributary drainage determined to be waters of the U.S. (Mining and Environmental Consultants, Inc. 1992)
- Although the larger pad would avoid suitable Arizona hedgehog cactus habitat, the smaller pad would be within suitable habitat and some occupied habitat (Cedar Creek Associates, Inc. 1994d, Map 4)

The numerous engineering, economic, and environmental disadvantages summarized above rendered this alternative to be infeasible, and it was therefore eliminated from further consideration.

Existing BHP Copper Pinto Valley Mine Tailings Impoundment (Site C)

The placement of the heap-leach pad on the existing BHP Copper Pinto Valley Cottonwood tailings impoundment also was initially investigated as an alternative (Knight Piésold 1994). However, the following deficiencies and disadvantages were identified for this alternative:

- Unpredictable settling of the heap caused by loading onto the loosely consolidated tailings material
- High moisture content of tailings deposited as slurry discharge, resulting in low subsurface densification for a poor leach pad foundation
- Greater magnitude of settling given the depth of the tailings foundation material, resulting in a lack of control of the leach pad surface and difficulty containing/managing process solutions
- Legal difficulties associated with BHP Copper's ownership of the existing facility and BHP Copper's existing CWA permits

Although this alternative would avoid waters of the U.S. and would not affect Arizona hedgehog cactus habitat, engineering-related and legal constraints make this alternative infeasible, and thus it was eliminated from further consideration.

Proposed Main Mine Rock Disposal Area (Site A)

When the mineable ore tonnage was initially estimated at 55 million tons, Carlota investigated the option of placing the heap-leach pad directly on top of the proposed Main mine rock disposal area. This alternative would reduce the amount of disturbed acres by placing the leach pad on a previously disturbed area of the mine rock disposal area, and the leach pad would not be located in the bottom of the Powers Gulch drainage.

The following engineering and/or environmental deficiencies and disadvantages were identified for this alternative:

- Lack of integrity of pad foundation and liner system caused by differential settling of the mine rock disposal area
- Loss of effective containment/management of process solutions because of lack of pad integrity
- Powers Gulch waters of the U.S. would be avoided, but other waters of the U.S. within the disposal area would still be impacted (Mining and Environmental Consultants, Inc. 1992)
- Greater visual impacts from the leach pad being placed on the waste dump at or above the existing skyline
- Inadequate volume to hold the entire 100 million tons of ore
- No net decrease in disturbed acres, since mine rock from the proposed Main rock disposal area would be placed at a different location

The following economic disadvantages also were identified:

- Additional preproduction costs of \$10 to \$12 million required to place 10 to 12 million tons of mine rock in the disposal area to establish an initial flat surface on which to place the first ore on the pad
- Additional operating costs associated with stockpiling and rehandling any ore encountered in the pit during the pad construction
- Costs associated with placing the ore at a higher elevation

The engineering-related, environmental, and economic deficiencies and disadvantages summarized above rendered this site infeasible, and it was eliminated from further consideration.

Area West of Eder Ridge (Including Sites 3 and 4)

This area was evaluated as an alternative to the Powers Gulch drainage. This general area is approximately 1 to 1.5 miles west of the proposed leach pad

location, and Sites 3 and 4 are included in this area (*Figure 2-20*). Site 3 is in the Mule Spring drainage, which covers approximately 940 acres. Some of the highest-quality wetlands in the project area have been identified in the Mule Spring vicinity. Site 4 is located in the drainage directly north of Mule Spring; this drainage covers approximately 760 acres. The entire surface of this general area is within the Apache Leap dacite lithologic unit, which is not a soil-builder and does not produce fine-grain surface material suitable for a leach pad subgrade. The topography of Site 4 is characterized by steep slopes and ridges that are greater than 30 percent over a majority of the area.

The following deficiencies or disadvantages were identified for the area located generally west of the Eder Ridge:

- Sites are underlain by Apache Leap dacite bedrock, resulting in unsuitable foundation conditions for a leach pad; suitable subgrade material is not present in the area.
- Potential leach pad slopes are predominantly greater than 30 percent in Site 4.
- Site 3 is centered on a drainage commonly referred to as the West Fork of Powers Gulch. The lower portion of this drainage has been identified as a water of the U.S., including approximately 0.3 acre of wetland known as Mule Spring (Mining and Environmental Consultants, Inc. 1992). It is likely that most of this drainage and at least one tributary would be determined to be waters of the U.S. Therefore, any benefits would be limited.
- Site 4 is centered on a drainage, the lower portion of which has been identified as being a water of the U.S. (Mining and Environmental Consultants, Inc. 1992). It is likely that all of the drainage determined to be a water of the U.S. would be impacted by any leach pad sited within this watershed.
- Site 3 would affect more Arizona hedgehog cactus habitat than the proposed location. Site 4

would affect potential Arizona hedgehog cactus habitat.

- Site 3 is located directly upstream of Mule Spring, which is a wetland regulated under Section 404 of the CWA and is recognized as a sensitive area.
- These sites are still upstream of lower Powers Gulch and Haunted Canyon, providing no advantage over the proposed location relative to impacts to these drainages.
- The increased hauling distance would increase air emissions.
- All sites are closer to the Superstition Wilderness than the proposed leach pad, resulting in the potential for greater air quality, visibility, and noise impacts to the wilderness.

The technical and environmental deficiencies summarized above rendered these sites infeasible, and they were eliminated from further consideration.

Fifty Dollar Spring Drainage (Site 5)

This site is located approximately 2 miles north-northwest of the proposed leach pad location, north of Haunted Canyon, and directly west of Carlota's proposed well field (*Figure 2-20*). The small basin is the drainage for Fifty Dollar Spring and is a tributary to Pinto Creek. The site covers approximately 500 acres. Similar to Sites 3 and 4, the surface of this site is predominantly within the Apache Leap dacite lithologic unit. The following deficiencies and disadvantages were identified for this area:

- This site is underlain by Apache Leap dacite bedrock, resulting in unsuitable foundation conditions for a leach pad; suitable subgrade material is not present in the area.
- Potential leach pad slopes are predominantly greater than 30 percent.
- This site drains directly to Pinto Creek, resulting in less time and space for mitigation or

remediation before solutions reach Pinto Creek in the event of a leach pad upset condition.

- A major crossing of Haunted Canyon and an increased haul distance would be required to access this site.
- Although this site has not had a formal determination on the presence of waters of the U.S., the site is centered on the Fifty Dollar Spring drainage. Its entire length would likely meet the waters of the U.S. criteria so that any pad siting would have little effect on reducing overall project impacts to waters of the U.S.
- This site is 2 miles closer to the Superstition Wilderness than the proposed leach pad, and it is not shielded from view from the Superstition Wilderness by the Eder Ridge. Visual impacts in the Superstition Wilderness would be greater with this site than with the proposed leach pad.
- Given its closer location to the Superstition Wilderness, there would be the potential for greater air quality, visibility, and noise impacts to the Superstition Wilderness with a leach pad at this site, compared with the proposed leach pad.

The technical and environmental deficiencies summarized above rendered this site infeasible; therefore, it was eliminated from further consideration.

Sites in Upper Powers Gulch (Area D)

This alternative considered sites farther up the drainage from the proposed heap location in order to reduce the watershed drainage area above the leach pad. The entire surface of this general area is within the Schultze granite lithologic unit, which is not a soil-builder and does not produce fine-grain surface material suitable for a leach pad subgrade. The topography characterized by steep slopes and ridges that are greater than 30 percent over a majority of the area. One site evaluated had the potential to reduce the impact to waters of the U.S. The following deficiencies and disadvantages were identified with this area:

- The area is underlain by Schultze granite bedrock with poor foundation conditions for a leach pad;

suitable subgrade material is not present in this area.

- Potential leach pad slopes are predominantly greater than 30 percent.
- This site would increase the amount of waters of the U.S. affected because Powers Gulch meets waters of the U.S. criteria to its source, and an upper tributary has been determined also to be waters of the U.S. (Mining and Environmental Consultants, Inc. 1992).
- Because this site is directly upstream from the proposed site, it offers little advantage in reducing risk to downstream resources in lower Powers Gulch and Haunted Canyon.
- Sites in this area would impact more occupied Arizona hedgehog cactus habitat than the proposed leach pad.
- Sites would still be upstream of lower Powers Gulch and Haunted Canyon; therefore, they have no advantage over the proposed location relative to impacts to these drainages.
- Sites have the potential for greater environmental impacts (air, noise, visual) to the Top-of-the-World subdivision than does the proposed leach pad.

The technical and environmental deficiencies summarized above rendered this site infeasible; therefore, it was eliminated from further consideration.

Area Upstream in Pinto Creek Drainage (Including Sites 1 and 2)

This area was evaluated to determine if numerous impacts to waters of the U.S. could be reduced. Sites evaluated in this relatively large general area included Sites 1 and 2 (*Figure 2-20*). Site 1 is located approximately 2 to 3 miles east of the Carlota project site and south and east of the Pinto Valley Mine Cottonwood tailings pond. The watershed for this area covers approximately 1,300 acres and consists of a number of tributary drainages to Pinto Creek. The area is bisected by the existing Pinto Valley Mine access road. Site 2 is located south of the Carlota

project site and directly north of U.S. Highway 60, along the ridge that divides Pinto Creek from Powers Gulch. The area of Site 2, which covers approximately 460 acres, is characterized by steep slopes that drop directly to Pinto Creek.

The following deficiencies and disadvantages were identified for sites in this general area, including Sites 1 and 2:

- The entire area is underlain by Schultze granite bedrock, with topography that is characterized by steep slopes and ridges that are commonly in excess of 30 percent.
- The surface of Site 2 is not a basin amenable to a leach pad. Other than the relatively narrow ridge, Site 2 consists of steep slopes that drop directly to Pinto Creek. There is no area that would allow for the construction of a leach pad embankment prior to reaching Pinto Creek.
- The granite surface results in foundation conditions unsuitable for a leach pad; suitable subgrade material is not present in the area.
- Multiple drainages would provide poor solution containment within Site 1.
- Site 1 was not evaluated for waters of the U.S.; however, it is probable that drainages in the less steep, central portion of the site would meet waters of the U.S. criteria, limiting advantages over the proposed site.
- Site 2 is centered on a drainage, the lower portion of which has been delineated as waters of the U.S. It is likely that the entire drainage through the site would meet waters of the U.S. criteria; therefore, no advantage is gained over the proposed site.
- There is greater potential for impacts to the Arizona hedgehog cactus. The Schultze granite is documented cactus habitat. Site 1 contains potential habitat, but no Arizona hedgehog cactus

have been confirmed within this area. Site 2 is in confirmed occupied habitat.

- All of the sites in this area drain directly to Pinto Creek, resulting in less time and space for mitigation or remediation before solutions reach Pinto Creek in the event of a leach pad upset condition.
- Sites in this area, especially Site 1, could conflict with operating plans of neighboring operations.
- Site 1 would be easily visible from Highway 60 and would have a substantially greater potential for significant visual impacts than would the proposed leach pad.
- Site 2 is closer to the community of Top-of-the-World than the proposed leach pad and would have the potential for greater visual impacts to viewpoints along Highway 60 and possibly to Top-of-the-World.
- Sites in this general area, and especially sites south of Highway 60, would have significantly higher capital and operating costs.

The technical and environmental deficiencies summarized above rendered this area infeasible, and it was eliminated from further consideration.

Area Northeast of Carlota/Cactus Pit (Area E)

This area was evaluated in an attempt to consolidate disturbance areas. The following disadvantages were identified.

- Area is within private property owned by BHP Copper
- Miller Springs drainage and two tributaries were determined to contain waters of the U.S., including wetlands (Mining and Environmental Consultants, Inc. 1992). The location would therefore be a disadvantage over the proposed site

- Sites within this area require increased crossings of Pinto Creek

These ownership and environmental deficiencies rendered this area infeasible, and it was eliminated from further consideration.

2.2.2.4 Stream Diversion Alternatives

Diversion with Flow-Restricting Dam

This alternative would involve constructing a metering (flood control) dam on Pinto Creek to control peak flows during runoff from high precipitation events. The purpose of this alternative would be to temporarily store storm runoff and provide for controlled releases at reduced rates, thereby accommodating a reduction in the size of the downstream diversion channel and reducing the risk of overtopping the diversion channel during runoff. A metering outlet located at the bottom of the dam would restrict the outflow rates to 50 percent of the peak inflow design rate. The estimated peak design inflow rate from a 500-year precipitation event for the Pinto Creek drainage basin is 10,100 cfs; therefore, the maximum outflow rate is approximately 5,500 cfs (SLA 1991).

Disadvantages associated with the flow-restricting dam are described below:

- The Pinto Creek dam would require continuous long-term maintenance to ensure the metering outlet at the bottom of the dam remains free of sediment and debris (Carlota 1994c).
- There is uncertainty in procuring water rights for temporary water storage.
- Upon mine closure and the cessation of maintenance activities, there is a significant potential to collect sediment behind the dam, thereby reducing sediment flow through the diversion and increasing the potential for scour degradation of the downstream channel (Carlota 1994c).

Based on these disadvantages, the alternative of constructing and operating a flow-restricting dam on

Pinto Creek was eliminated from detailed consideration in the EIS.

Enclosed Conduit for Diversions

An enclosed conduit for diverting surface water flows in Pinto Creek and Powers Gulch has been evaluated. The enclosed conduit was considered in an effort to address possible blockage from sloughing of banks and to attempt to totally enclose the flow beyond the areas of diversion. Total enclosure would minimize potential impacts caused by the adjacent structures, such as the Carlota/Cactus pit and the heap-leach pad. However, evaluation of the enclosed conduit identified the following problems:

- The size of the enclosed diversion channel would be large, difficult to construct, and very expensive.
- The potential for plugging cannot be eliminated; in comparison, an open channel may become plugged but would not lose all of its capacity and could be quickly cleared.
- The possible accumulation of sediment in a conduit would require constant monitoring and maintenance throughout operations and after mine closure.

For these technical and economic reasons, this alternative is not considered feasible and has not been evaluated in further detail.

2.2.2.5 Water Supply Alternatives

Low-Quality Water from the Gibson Mine

The Gibson Mine is located in Section 21, T1S, R14E in Gila County, approximately 5 miles south of the proposed project. Access to the site is via Forest Service Road 349 for approximately 2 miles south from the intersection of U.S. Highway 60 and the Pinto Valley Mine road, and then approximately 1 mile southwest on Forest Service Road 3.

The Gibson Mine is an underground copper mine that is currently idle. Underground mining and in situ leaching have previously been conducted at the site,

and a water well exists near the shaft. Currently, water from the workings seeps into the Pinto and Mineral Creek drainages. The quality of this seepage, based on samples collected during 1990, 1991, and 1992, is poor, with high dissolved solids and low pH. Copper, iron, manganese, zinc, and sulfate make up a high portion of the dissolved solids. This seepage is in violation of the rules and standards of the ADEQ. As a result of this violation(s), ADEQ is working with the landowner to develop a remediation plan.

The quantity of water that could be produced in this manner for the proposed project is not known. Production of this water would involve specialized pumps, pipes, valves, and other equipment because of the low pH of the water and the high dissolved solids. Since issuance of the Draft EIS, Carlota has acquired an option on the Gibson Mine property to test its potential as a supplemental water supply for the Carlota Copper Project. Pump testing was conducted by Carlota to investigate the storage and recharge potential for water in the flooded underground workings (GWRC 1997). The workings contained approximately 10 million gallons of water. Recharge was on the order of only 20 to 40 gpm depending on the elevation of water in the mine (GRWC 1997). Full refill of the workings was not achieved after 7 months. To date, these initial pump tests have not confirmed that an adequate supply of water is available from existing mine workings to justify the costs of acquiring and remediating existing environmental impacts and the costs necessary to develop and use the water.

If further testing of the Gibson Mine water indicates it would be a viable water resource, then an appropriate environmental analysis would be conducted to potentially include the Gibson Mine as a supplemental water supply for the Carlota Copper Project.

Acquisition of Central Arizona Project Water (Water Exchange and Pipeline from Roosevelt Lake)

This alternative considered using water from the Central Arizona Project (CAP) for the Carlota Copper Project. The primary components of this alternative would include an exchange of water from the CAP to the Salt River Project and a pipeline from Roosevelt Lake to the Globe/Miami, Arizona, area for municipal use. Carlota would be required to construct a pipeline

from the Globe/Miami area to the project site with associated pumping stations and access road.

The costs (estimated at \$24 to \$28 million) associated with an alternative involving an exchange of water between CAP and Salt River Project and construction and operation of a pipeline would necessitate the participation of other users in addition to Carlota in order for the exchange to be feasible. The demands from a combination of public water departments (Miami, Globe, regional, etc.) and area mines (Cyprus Miami Mining Corporation, BHP Copper, and others) would possibly be sufficient to support the construction and operation of the required facilities and make this alternative feasible. The availability of water to the proposed project would depend on the need and the time required to complete the exchange and construction of the pipeline facilities from Roosevelt Lake. A possible pipeline route is from the Salt River arm of Roosevelt Lake along State Highway 88 to Globe.

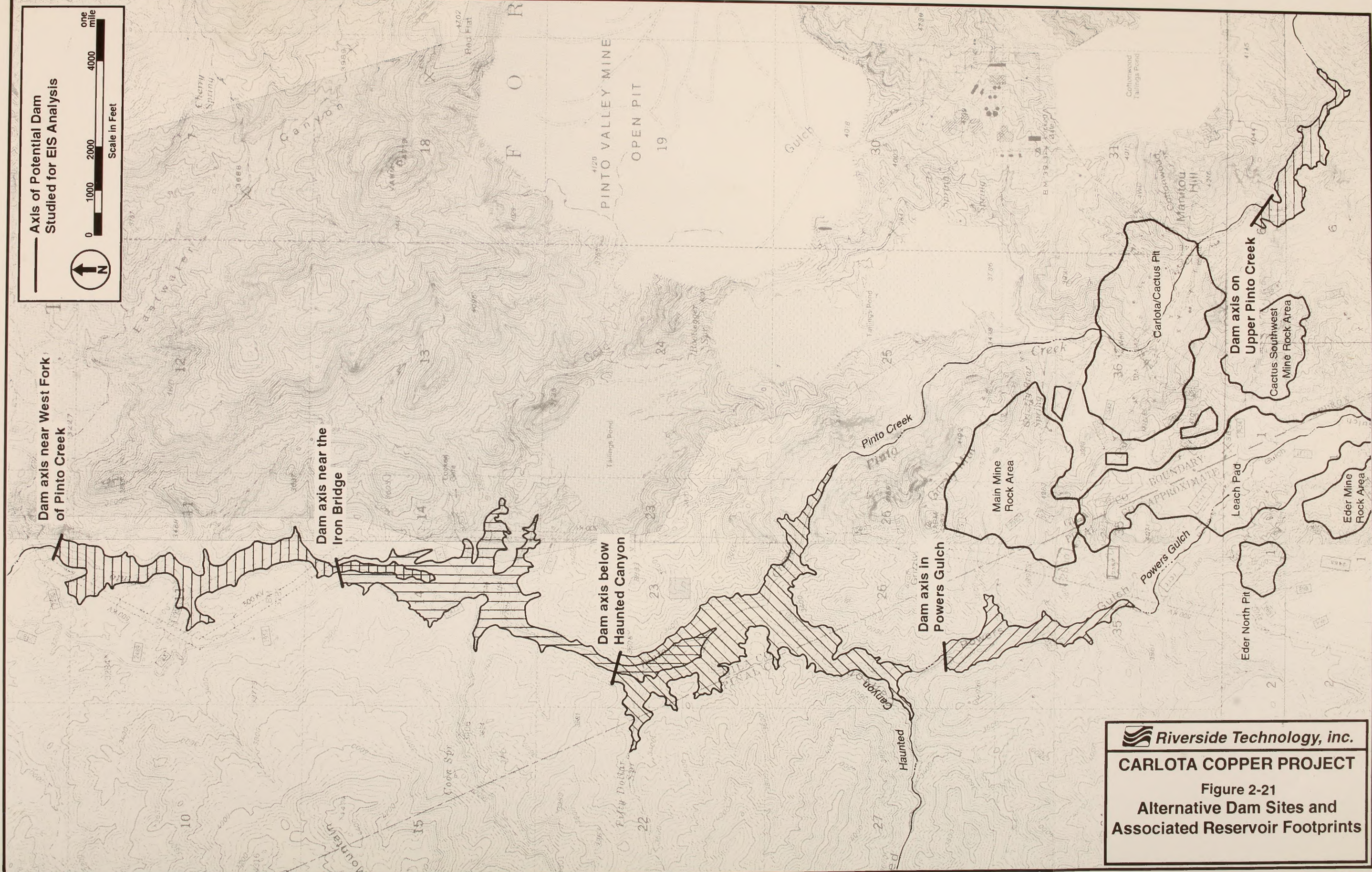
The schedule of water availability from this potential source is unknown, but it would likely be over 10 years in the future; therefore, water would not be available for use during the initial operation period of the proposed project. As a result, this water source is not considered a feasible alternative for the Carlota Copper Project.

Surface Water Reservoir Alternatives

A preliminary hydrologic screening of five potential reservoir sites was conducted on Pinto Creek and Powers Gulch to determine the feasibility of a surface water reservoir as a complete or partial water supply for the Carlota Copper Project. Water from pit dewatering was considered in combination with the surface water reservoir alternatives.

The five sites were identified based on water supply and engineering design objectives. These sites are shown in *Figure 2-21* and listed below:

- Pinto Creek just upstream of the Carlota/Cactus pit (NW1/4, NE1/4, Section 6, T1S, R14E)
- Powers Gulch (near the center, SW1/4, Section 26, T1N, R13E)



- Pinto Creek near Haunted Canyon (SW1/4, NW1/4, Section 23, T1N, R13E)
- Pinto Creek near the Iron Bridge (NW1/4, NE1/4, Section 14, T1N, R13E)
- Pinto Creek near gaging station PC-8 (SW1/4, SE1/4, Section 2, T1N, R13E)

Reservoir storage capacities were first determined for various dam heights at each site. The synthetic streamflows for a 20-year flow record for each site were then determined based on existing precipitation records and a highly correlative statistical relationship between mean annual precipitation and mean annual streamflow measured in the Pinto Valley locale.

It should be noted that the preliminary analyses did not consider reservoir seepage or minimum streamflow requirements in the hydrologic analyses. Evaporation and project-related drafts were the only outflows considered; streamflow runoff from precipitation was the only inflow considered.

Even under these optimistic conditions, it was determined that only two of the sites would potentially provide enough water for the project. An inadequate supply would likely result from either insufficient runoff volume and/or insufficient storage volume. The timing of runoff would also be a limiting factor; depending on reservoir storage capacity, a portion of runoff may have to be spilled in the spring. A critical concern is the lack of water to maintain or supplement supplies over an extended drought. Such periods, lasting 3 to 5 years, have occurred during the precipitation record and would likely occur during the life of the project. Inadequate supply factors eliminated Sites 1, 2, and 5 from further consideration.

Other factors severely constrained all of the sites, including the remaining sites (Sites 3 and 4). These limiting factors included:

- The occurrence of privately owned lands or other properties
- Potential hazards to downstream life or property from dam failure

- Uncertain fate and ownership of the dam and reservoir upon project closure
- Occurrence of threatened or endangered species or candidate species
- Uncertainty of procuring surface water rights
- Sediment infilling of the reservoir and corresponding sediment transport imbalances
- Very high (i.e., infeasible) construction/maintenance/demolition costs
- Elimination of wetland or riparian areas
- Introduction of non-native aquatic species
- Potential to affect streamflow in the reach of Pinto Creek being considered for inclusion in the Wild and Scenic River system

Discussions regarding each potential site are provided below.

Pinto Creek Just Upstream of the Carlota/Cactus

Pit. This site would be particularly limited by the uncertainty of a reliable water supply. General water balance calculations indicated that the reservoir would go dry during dry years. Limiting factors 2, 3, 5, 6, 7, and 10 would also be major constraints on this site.

Powers Gulch Downstream of the Heap-Leach

Pad. This site would be particularly limited by the uncertainty of a reliable water supply. The very small contributing watershed area makes it unlikely that the reservoir could be filled, and it would be rapidly emptied during dry periods. Limiting factors 2, 3, 5, 6, 7, and 9 would also be major constraints on this site.

Pinto Creek Near Haunted Canyon. Preliminary results indicated that this site could provide an adequate water supply. However, limiting factors 8, 9, and 10 would be primary constraints on this site, particularly since reservoir waters would inundate part of Haunted Canyon. Limiting factors 2 through 7 would also affect this site. A reservoir at this site would also inundate the proposed well field.

Pinto Creek Near the Iron Bridge. Preliminary results indicate that this site could provide adequate water supplies. However, all limiting factors would be constraints on this site. Reservoir construction would necessitate rerouting Forest Service Roads 287, 287A, 203, and 3037, in addition to the probable removal of Iron Bridge. At least one well, located on private land owned by BHP Copper Company, would be inundated, as would part of the proposed well field.

Pinto Creek Near the West Fork of Pinto Creek.

This site would be particularly limited by the inability to provide a reliable water supply. All limiting factors would also be constraints to this site.

Based on the results of this evaluation, surface water reservoirs were eliminated from detailed consideration as alternatives in this EIS. Potential water from dewatering the pits also was considered in combination with water from reservoir sites. Due to the same environmental, technical, and economic reasons cited above, this combined water supply alternative was not feasible.

Water Purchase from Municipalities or Other Commercial Sources

The Miami and Globe municipalities were contacted regarding the potential purchase of water to supply the project requirements. However, neither municipality had adequate additional water for the Carlota Copper project. Therefore, this alternative was not considered in detail.

2.2.2.6 Power Line Alternatives

New 22.2-kv Line from New Substation Near Top-of-the-World

This alternative, as described in the Plan of Operations dated February 1992, would involve constructing a new substation approximately 1 mile northeast of Top-of-the-World within an existing Salt River Project power line corridor. A 22.2-kv overhead line approximately 11,750 feet long would be constructed from the substation to the proposed processing plant site. The substation would occupy a small, 1-acre area adjacent to the existing Salt River Project corridor.

The existing access road associated with the Salt River Project corridor would be used for construction of the substation; a temporary access road of sufficient width to allow installation and maintenance of the line would be constructed. The steep terrain would necessitate switchbacks and curves to negotiate the route.

The total disturbance associated with constructing this power line alternative is estimated to be 10 acres. Reclamation activities would consist of removing the power line and substation and restoring the acreage by grading and planting the area disturbed for the power poles and access road.

This alternative was eliminated from detailed consideration because of the lack of environmental advantage over the proposed power line and the increased visual impacts of this alternative.

New 22.2-kv Line from Existing Substation at BHP Copper Pinto Valley Mine

This alternative would involve constructing a new overhead line from an existing substation located northeast of the proposed project at the Pinto Valley Mine. The power line would be approximately 8,500 feet long. This alternative assumed that sufficient capacity was available at the existing BHP Copper Pinto Valley Mine substation.

Approximately 2,000 feet of temporary access road would be required to construct the power line. The steep terrain would necessitate switchbacks and curves to negotiate the route.

The total disturbance associated with constructing this power line alternative was estimated to be 2 acres. Reclamation activities would consist of removing the power line and substation and restoring the acreage by grading and planting the area disturbed for the power poles and access road.

This alternative was discussed with Salt River Project officials and was eliminated from further consideration because of the lack of existing capacity at the substation to provide the required electricity to the Carlota Copper Project and the lack of sufficient area at the site to enable expansion of the substation.

2.2.2.7 Mine Access Road Alternatives

Alternative access roads, as described in Carlota's Plan of Operations dated February 1992, were considered from U.S. Highway 60 to the Carlota Copper Project facilities. These access road alternatives were eliminated from further analysis because there were no environmental advantages for their use.

2.3 Comparative Analysis of Alternatives

Tables 2.16-a through 2.16-p summarizes and compares the environmental impacts between the proposed action and the project alternatives. The key impacts associated with the proposed action and the agency preferred alternative are identified for each resource. The impacts associated with individual component alternatives are identified only as they differ from the same impact for the proposed action. Detailed descriptions of the impacts are presented in Chapter 3, Affected Environment and Environmental Consequences. The summarized impacts assume the absence of mitigation; implementing the monitoring and mitigation measures recommended in Chapter 3 would potentially reduce the impacts.

2.4 Agency Preferred Alternative

The Forest Service has selected Carlota's proposed action as the agency preferred alternative with the following modifications:

- Inclusion of the alternative to place additional backfill into the Eder South pit
- Inclusion of the water supply alternative to combine low-quality water, water supply wells, and dewatering wells
- Inclusion of access road alternative A in place of the proposed access road design to provide secondary access from the north to the well field

After Carlota's submission of its initial Plan of Operations, the Forest Service, other agencies, and public scoping identified a wide range of project alternatives (component alternatives) that potentially

offered less impact on the resources in the area. A number of these alternatives, such as partial backfilling of the Carlota/Cactus pit, access from the Pinto Valley Mine road, and incorporation of the PLS ponds within the leach pad were subsequently incorporated into the proposed action.

Following the public comment period for the Draft EIS, additional changes were made to further address issues. Potential alternatives that had been eliminated from detailed consideration were redefined and reassessed with regard to technical, legal, and economic feasibility. An inlet control structure to regulate flows into the Powers Gulch diversion was incorporated into the leach pad design. Another potential source for low-quality water, BHP Copper's Cottonwood storage pond, was identified. New design technology with higher standards for heap-leach solution containment and water conservation measures were incorporated into the proposed action. Also, monitoring and mitigation measures were more fully developed.

Impacts of the agency preferred alternative on environmental resources would provide a higher level of environmental protection than the proposed action. The impacts of the agency preferred alternative are listed in the impact comparison tables (*Tables 2.16-a through 2.16-p*).

The key impact differences between the proposed action and the agency preferred alternative relate to an increase in the area to be reclaimed, a reduction in the potential for localized sedimentation, a potential decrease in the use of local aquifers, and elimination of a new access road outside of the immediate project area.

The key impact differences associated with the additional backfill of the Eder South pit are described below.

- Air Quality - Slight decreases in long-term air emissions
- Geology and Minerals - Increased long-term stability of the Eder South pit wall, Eder slope, and Powers Gulch area; reduced threat to Powers Gulch diversion system and heap-leach pad

- Water Resources - Reduced long-term risks of sediment transport and potential impacts to Powers Gulch diversion because of the elimination of the Eder mine rock area at closure
- Soils and Reclamation - Additional reclaimed areas within the pit and at the disposal site; increased costs; reduced potential for erosion because of the elimination of the Eder mine rock disposal area
- Terrestrial Biology - Additional reclaimed areas for upland vegetation and associated wildlife; increased potential area for reclaiming upland habitat, especially for sensitive species, such as loggerhead shrike
- Socioeconomics - Beneficial and adverse impacts of workforce for additional 2.3 months
- Land Use - Additional reclaimed areas associated with the additional backfill of the Eder South pit and Eder mine rock area available for postmining uses
- Visual Resources - Reduced visible extent of disturbed areas and a more open view of the background
- Noise - Slight, temporary increased noise levels

The key impact differences associated with using low-quality water in addition to water supply wells and dewatering wells are described below:

- Geology and Minerals - Addition of several miles of low-quality water pipeline and associated risks to pipeline from landslides and slope instability

- Water Resources - Potential reduction of impacts to Haunted Canyon and Pinto Creek associated with water supply well field pumping (If the pipeline is damaged during the life of the project, water released could potentially affect ground and/or surface water quality.)
- Land Use - Potential for an additional pipeline right-of-way on National Forest System lands
- Aquatic Biology - Less potential for reducing surface water flow; therefore, reduced impacts to aquatic biota

The key impact differences associated with using the Alternative A access road to the well field include the following:

- Geology and Minerals - Reduced soil disturbance and erosion in a portion of Pinto Creek. Reduced risk of induced slope instability
- Water Resources - Located in the Pinto Creek flood plain; more efficient access to water monitoring sites
- Soils and Reclamation - Slight decrease in soil disturbance; no new road construction
- Terrestrial Biology - Continued disturbance of riparian vegetation during project operations
- Land Use - Reduced land use disturbance in Pinto Creek area
- Recreation - Slight reductions in noise and visual impacts on hiking and horseback riding

Table 2.16-a. Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation Air Resources

	Mine Rock Disposal Alternatives				Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	Eder Side-Hill Leach Pad Alternative	
Proposed Action	Project emissions would increase ambient PM_{10} , NO_x , CO , and SO_2 concentrations above background levels at locations downwind of the project site. However, these concentrations are not predicted to exceed the National Ambient Air Quality Standards outside the project's boundary limiting public access. The Level 3 visibility modeling analysis shows the potential for perceptible plume impacts to occur at observer locations within the Superstition Wilderness.	Slight increase in air emissions (0-5 percent).	Slight decrease in long-term air emissions; short-term impacts would be similar to proposed action.	Slight decrease in long-term air emissions; short-term impacts would be similar to proposed action.	Slight increase in fugitive dust emissions; other air emissions would be similar to proposed action.

	Water Supply Well Field Access Roads			No Action
	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Access Road Alternative A	Access Road Alternative B	
Proposed Action	Project emissions would increase ambient PM_{10} , NO_x , CO , and SO_2 concentrations above background levels at locations downwind of the project site. However, these concentrations are not predicted to exceed the National Ambient Air Quality Standards outside the project's boundary limiting public access. The Level 3 visibility modeling analysis shows the potential for perceptible plume impacts to occur at observer locations within the Superstition Wilderness.	Minor changes in air emissions.	Minor changes in air emissions.	Existing background air characteristics would be maintained.

Table 2.16-b. Summary of Comparison Impacts Between the Proposed Action and Alternatives without Mitigation
Geology and Minerals

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Disturbance to approximately 1,428 acres of surficial materials.	Total area disturbed would increase by approximately 44 acres.			
Relocation of 211 million tons of mine rock to mine rock areas and backfill for pits.				
Generation of 100 million tons of spent ore to be left in closed and reclaimed heap-leach facility.				
Extraction of 900 million pounds of copper.	No impacts on mineral resources.	Approximately 14 million tons of mineral resource would remain.	Approximately 25 million tons of mineral resource would remain.	
Minor risk of damage to facilities from pre-existing major landslides and slope instability.				
Potential for future pit wall instability to damage facilities.				
Potential effects on leach pad liner from settling and/or subsidence in an area beneath the heap.				
Moderate to high risk of induced landslides due to water supply access road.				
High potential for increased sedimentation in Pinto Creek from water supply access road until BMPs are implemented.				
Low risk of seismic damage to heap-leach pad and process solution ponds due to implementation of required design and construction procedures.				
Potential for landslides, slope failures in mine rock piles, or failure of pit walls.	Similar to relevant portion of proposed action in terms of slope stability, seismicity, and landslides.	Long-term stability of the pit walls would increase, and potential for slope failure of Carlota/Cactus pit wall would be eliminated.	Long-term stability of Eder South pit walls would increase.	Increased potential for slope instability associated with side-slope configuration.
Potential for small slope failures to damage Powers Gulch diversion structure.				

**Table 2.16-b. Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation
Geology and Minerals (continued)**

Proposed Action	Water Supply Alternative	Water Supply Well Field Access Roads		No Action
	Low-Quality Water, Water Supply Wells, and Dewatering Wells	Access Road Alternative A	Access Road Alternative B	
<p>Disturbance to approximately 1,428 acres of surficial materials.</p> <p>Relocation of 211 million tons of mine rock to mine rock areas and backfill for pits.</p> <p>Generation of 100 million tons of spent ore to be left in closed and reclaimed heap-leach facility.</p> <p>Extraction of 900 million pounds of copper.</p> <p>Minor risk of damage to facilities from pre-existing major landslides and slope instability.</p> <p>Potential effects on leach pad liner from settling and/or subsidence in an area beneath the heap.</p> <p>Moderate to high risk of induced landslides due to water supply access road.</p> <p>High potential for increased sedimentation in Pinto Creek from water supply access road until BMPs are implemented.</p> <p>Low risk of seismic damage to heap-leach pad and process solution ponds due to implementation of required design and construction procedures.</p> <p>Potential for landslides, slope failures in mine rock piles, or failure of pit walls.</p> <p>Potential for small slope failures in Powers Gulch, including instability in the Eder mine rock disposal area, to damage Powers Gulch diversion structure.</p>	<p>Potential risk to water pipeline from landslides or slope instability.</p>	<p>Low risk of damage to road from slope failure.</p> <p>Moderate to high potential for increased sedimentation in Pinto Creek until BMPs are implemented.</p>	<p>Low risk of damage to road from slope failure.</p> <p>Moderate potential for increased sedimentation in Pinto Creek until BMPs are implemented.</p>	<p>No disturbance to surficial materials.</p> <p>No recovery of approximately 900 million pounds of copper.</p>

Table 2.16-c. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Water Resources

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
<p>Removal and consumption of ground water from well field extraction and mine dewatering.</p> <p>Water levels in existing bedrock water supply wells, located in vicinity of open pits or well field, may decline because of drawdown.</p> <p>Flows may be reduced or eliminated in streams, natural springs, and seeps because of well field development and mine dewatering.</p> <p>Alluvial underflow may be reduced in Pinto Creek and Haunted Canyon as a result of ground water withdrawal from well field and mine dewatering.</p> <p>Loss of approximately 480 acre-feet per year from evaporation once pit lake reaches equilibrium.</p>		<p>Additional backfill would prevent a pit lake from forming; pit water quality and evaporative losses would not occur.</p> <p>Restoration of 0.5 mi² of contributing watershed area.</p>		<p>Temporary removal of additional 29 acre-feet of runoff from removal of Powers Gulch watershed area.</p>
<p>Potential overtopping of Pinto Creek diversion could direct a portion of Pinto Creek flow into Carlota/Cactus pit and temporarily reduce flows downstream in Pinto Creek.</p> <p>Accidental release of process solutions from heap-leach facility during operation or leachate contained in heap-leach postclosure could contaminate surface and ground water.</p> <p>Potential postclosure failure of Powers Gulch diversion and flows into reclaimed leach pad could create adverse impacts to surface and ground water quality and erosion and sedimentation problems.</p>		<p>Surface water quantity impacts would be similar to proposed action.</p>	<p>Additional backfill would eliminate Eder mine rock area, thereby improving slope stability and reducing potential for mine rock to migrate downslope and affect water conveyance and sediment transport in Powers Gulch diversion.</p>	<p>Increased risk of release of solutions and heap-leach material from slope instability.</p> <p>Eliminates need for construction of Powers Gulch diversion; however, approximately 2,100 feet of Powers Gulch could require realignment.</p> <p>Elimination of potential risk to heap from failure of Powers Gulch diversion.</p> <p>Elimination of impacts to heap associated with seasonally high ground water conditions in Powers Gulch.</p>

Table 2.16-c. Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation Water Resources (continued)

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Potential contaminant transport from mine rock disposal areas and impacts to surface water.	Surface water quantity impacts would be minimal because both alternative sites would consist of free-draining rock materials. Existing poor quality surface water may move through or pond behind Cactus South location. Potential water quality impacts from Cactus Central site would be minor and similar to proposed action.			
Permanent loss of 39 acres of alluvial floodplain in Pinto Creek and Powers Gulch. Temporary, localized effects of sedimentation and erosion due to construction and operation would result in minor impacts to overall watershed.				Due to increased acreage and slopes, erosion and sediment yield would increase with this leach pad alternative during postclosure.

Table 2.16-c. Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation Water Resources (continued)

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads		No Action
		Access Road Alternative A	Access Road Alternative B	
Removal and consumption of ground water from well field extraction and mine dewatering.	Reduction in ground water withdrawal from well field, thereby reducing associated impacts to surface and ground water resources.			Continuation of existing ground water and surface water conditions.
Water levels in existing bedrock water supply wells, located in vicinity of open pits or well field, may decline because of drawdown.	Reduction in ground water withdrawal from well field, thereby reducing associated impacts to surface and ground water resources.			
Flows may be reduced or eliminated in streams, natural springs, and seeps because of well field development and mine dewatering.	Reduction in ground water withdrawal from well field, thereby reducing associated impacts to surface and ground water resources.			
Alluvial underflow may be reduced in Pinto Creek and Haunted Canyon as a result of ground water withdrawal from well field and mine dewatering.				Continuation of existing ground water and surface water conditions.
Loss of approximately 480 acre-feet per year from evaporation once pit lake reaches equilibrium.				
Temporary withdrawal of 171 acre-feet and permanent withdrawal of less than 70 acre-feet of runoff from removal of contributing watershed area.				
Potential overtopping of Pinto Creek diversion could direct a portion of Pinto Creek flow into Carlot/Cactus pit and temporarily reduce flows downstream in Pinto Creek.				
Accidental release of process solutions from heap-leach facility during operation or leachate contained in heap-leach postclosure could contaminate surface and ground water.	Potential for pipeline to rupture during life of project. Water released from pipeline could contaminate surface and ground water.			
Potential postclosure failure of Powers Gulch diversion and flows into reclaimed leach pad could create adverse impacts to surface and ground water quality and erosion and sedimentation problems.				
Potential contaminant transport from mine rock disposal areas and impacts to surface water.				
Permanent loss of 39 acres of alluvial floodplain in Pinto Creek and Powers Gulch.				
Temporary, localized effects of sedimentation and erosion due to construction and operation would result in minor impacts to overall watershed.		Minor sedimentation and erosion impacts, similar to access road component of proposed action.	Minor sedimentation and erosion impacts, similar to access road component of proposed action.	

Table 2.16-d. Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation
Soils and Reclamation

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Soil disturbance to approximately 1,428 acres (1,207 acres from excavation or other earthwork).	Additional disturbance to approximately 44 acres of native soils.	Creation of an additional 110 acres of reclaimable area within the pit and 43 acres at the Main mine rock disposal area.	Creation of additional 16 acres of reclaimable area within pit and approximately 33 acres at Eder disposal area.	Additional disturbance to approximately 134 acres of soils.
Salvaged soils (topsoil) would be redistributed on approximately 270 acres.	Provide additional topsoil for reclamation of approximately 27 acres at mine rock disposal sites.			
Reseeding without topsoil would occur on approximately 447 acres.				
Long-term loss of soil productivity on 490 acres.				
Postreclamation objectives would not be met on approximately 490 acres.		Substantial increase in reclamation costs.	Substantial increase in reclamation costs.	Reduction in amount of topsoil available for reclamation.
Long-term soil productivity would be decreased on approximately 221 acres due to traffic and light duty construction activities.	Soil erosion and loss of productivity impacts would be similar to mine rock components of proposed action.		Soil erosion and loss of soil productivity impacts would be similar to pit backfill areas of proposed action.	Net loss of approximately 34 acres of soils from post-mining land uses.
Postdisturbance soil erosion on sideslopes (20 to 30 tons/acre/year at leach pad and 4.9 tons/acre/year for other project components).	Soil erosion and loss of productivity impacts would be similar to mine rock components of proposed action.		Soil erosion and loss of soil productivity impacts would be similar to pit backfill areas of proposed action.	
Postdisturbance erosion rates of less than 1 ton/year/acre on the top surfaces for all project activities.	Soil erosion and loss of productivity impacts would be similar to mine rock components of proposed action.		Soil erosion and loss of soil productivity impacts would be similar to pit backfill areas of proposed action.	
Loss of approximately 80,000 yd ³ of salvaged topsoil due to transportation losses and salvage limitations.	Soil erosion and loss of productivity impacts would be similar to mine rock components of proposed action.		Soil erosion and loss of soil productivity impacts would be similar to pit backfill areas of proposed action.	
Decreased productivity of salvaged topsoil due to removal, compaction, and fertility losses.	Soil erosion and loss of productivity impacts would be similar to mine rock components of proposed action.		Soil erosion and loss of soil productivity impacts would be similar to pit backfill areas of proposed action.	

**Table 2.16-d Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation
Soils and Reclamation (continued)**

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Potential heap leach failure long-term due to erosional effects.	Soil erosion and loss of productivity impacts would be similar to mine rock components of proposed action.		Soil erosion and loss of soil productivity impacts would be similar to pit backfill areas of proposed action.	
Long-term increase in erosion and sedimentation in the unlikely event of diversion failure.	Soil erosion and loss of productivity impacts would be similar to mine rock components of proposed action.	Reduced erosion potential due to decreased size of mine rock disposal areas.	Soil erosion and loss of soil productivity impacts would be similar to pit backfill areas of proposed action.	
Disturbance of 12.4 acres of alluvial soils occupied by riparian habitat.				Reduction in disturbance to alluvial soils (approximately .9 acre) potentially occupied by riparian vegetation.

Table 2.16-d Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation Soils and Reclamation (continued)

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells		Water Supply Well Field Access Roads		No Action
			Access Road Alternative A	Access Road Alternative B	
<p>Soil disturbance to approximately 1,428 acres (1,207 acres from excavation or other earthwork).</p> <p>Salvaged soils (topsoil) would be redistributed on approximately 270 acres.</p> <p>Reseeding without topsoil would occur on approximately 668 acres.</p> <p>Long-term loss of approximately 490 acres of soils from post-mining land uses.</p> <p>Postreclamation objectives would not be met on approximately 490 acres.</p> <p>Long-term soil productivity would be decreased on approximately 221 acres due to traffic and light duty construction activities.</p> <p>Postdisturbance soil erosion on sideslopes (20 to 30 tons/acre/year at leach pad and 4.9 tons/acre/year for other project components).</p> <p>Postdisturbance erosion rates of less than 1 ton/year/acre on the top surfaces for all project activities.</p> <p>Loss of approximately 80,000 yd³ of salvaged topsoil due to transportation losses and salvage limitations.</p> <p>Decreased productivity of salvaged topsoil due to removal, compaction, and fertility losses.</p> <p>Potential heap leach failure long-term due to erosional effects.</p> <p>Long-term increase in erosion and sedimentation in the unlikely event of diversion failure.</p> <p>Disturbance of 12.4 acres of alluvial soils occupied by riparian habitat.</p>			<p>Minor impacts to soils after reclamation, similar to access road component of proposed action.</p>	<p>Minor impacts to soils after reclamation, similar to access road component of proposed action.</p>	<p>Continuation of existing soil conditions.</p>

Table 2.16-e. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Terrestrial Biology

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Direct disturbance of approximately 798 acres of interior chaparral, 490 acres of dry-slope desert brush, 118 acres of juniper/ grassland, and 22 acres of riparian deciduous woodland vegetation from project facilities.	Direct disturbance to upland vegetation on an additional 44 acres.	Approximately 153 additional acres of vegetation and wildlife habitat would be reclaimed and revegetated.	Upland vegetation would be reclaimed on approximately 49 additional acres within Eder South pit and Eder mine rock disposal area.	Loss of approximately 134 additional acres of interior chaparral and juniper/grassland; net loss of approximately 34 acres of reclaimable area.
Low risk for direct effects of spills or accidental leaks on riparian vegetation and associated wildlife species (amphibians, birds, and mammals).	Temporary sedimentation and possible adverse water quality effects on amphibians would be greater than proposed action.			Sedimentation (temporary) and water quality impacts would be reduced by placing pad outside main Powers Gulch drainage; however, side-hill configuration would increase potential for heap slope failure and accidental release of leach solutions and materials into Powers Gulch and downstream.
Low risk for indirect effects on riparian vegetation along Powers Gulch, Haunted Canyon, and Pinto Creek from dewatering pits, water withdrawal from wells, and localized sedimentation.				Increase in potential indirect impacts to amphibian species from accidental release of leach solutions and materials.
				Sedimentation (temporary) and water quality impacts would be reduced by placing pad outside main Powers Gulch drainage; however, side-hill configuration would increase potential for heap slope failure and accidental release of leach solutions and materials into Powers Gulch and downstream.
Loss of upland and riparian vegetation would affect habitat used by reptiles, amphibians, birds, and mammals.		Effects on associated wildlife species would be similar to the pit backfill component of proposed action, but magnitude would be less.		Potential effect on common black-hawk through increased indirect impacts to amphibian food sources and riparian habitat.
Minor effects of habitat loss on big game species, such as mule deer, white-tailed deer, collared peccary, black bear, and mountain lion.		Effects on associated wildlife species would be similar to the pit backfill component of proposed action, but magnitude would be less.		

Table 2.16-e. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation Terrestrial Biology (continued)

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells		Water Supply Well Field Access Roads		No Action
			Access Road Alternative A	Access Road Alternative B	
Direct disturbance of approximately 798 acres of interior chaparral, 490 acres of dry-slope desert brush, 118 acres of juniper/grassland, and 22 acres of riparian deciduous woodland vegetation from project facilities.					Continuation of existing terrestrial conditions.
Low risk for direct effects of spills or accidental leaks on riparian vegetation and associated wildlife species (amphibians, birds, and mammals).	Potential water quality effects from accidental spill or leak of low-quality water.				
Low risk for indirect effects on riparian vegetation along Powers Gulch, Haunted Canyon, and Pinto Creek from dewatering pits, water withdrawal from wells, and localized sedimentation.	Reduced effects of dewatering on riparian vegetation and associated wildlife species since less water would be pumped from wells.		Removal of approximately 4 acres of previously disturbed riparian vegetation.		
Loss of upland and riparian vegetation would affect habitat used by reptiles, amphibians, birds, and mammals. Minor effects of habitat loss on big game species such as mule deer, white-tailed deer, collared peccary, black bear, and mountain lion.	Reduced effects of dewatering on riparian vegetation and associated wildlife species since less water would be pumped from wells.		Removal of riparian habitat would impact amphibian population, thereby affecting food source of common black-hawk.	Removal of a 1.2-mile (7 acres) length of upland vegetation.	

Table 2.16-f. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Aquatic Biology

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of South Eder Pit	Side-Hill Leach Pad Alternative
Loss of habitat (approximately 1.24 acres in Pinto Creek and 0.84 acre in Powers Gulch) from stream diversions. These habitat reductions would affect fish and invertebrate populations in Pinto Creek and invertebrate populations in Powers Gulch.				Powers Gulch aquatic habitat would not be lost since pads would be constructed outside of main channel.
Dewatering of Carlota/ Cactus pit would affect approximately 1 acre of aquatic habitat in Pinto Creek.				
Potential decreases in streamflow from water supply well pumping could reduce flows in Haunted Canyon and Pinto Creek, which could decrease available habitat for aquatic communities, including longfin dace and desert sucker.	Impacts from sedimentation on longfin dace and desert sucker would be greater.			
Potential toxic effects of heavy metals and reduced pH on aquatic biota from low risk of accidental discharge of mine solutions and materials.				Increased risk of release of solutions and heap-leach material from slope instability. Leaks or spills from PLS ponds could affect invertebrate communities in Powers Gulch.
Potential for the water quality in the pit lakes to affect aquatic resources.	Potential for adverse aquatic impacts from combined Cactus South site and existing poor-quality flow from Cottonwood Gulch through the site.	Similar to pit backfill component of proposed action in terms of temporary sedimentation and water quality impacts on aquatic communities during operational phase. Potential for sedimentation could be reduced after reclamation since an additional 0.4 mi ² of watershed would be restored.	Backfilling the South Eder Pit would preclude formation of a pit lake, thereby limiting the adverse effects of pit lake water quality to the Carlota/Cactus Pit. Eder mine rock area would be eliminated, thereby improving slope stability and reducing potential for mine rock to migrate downslope and affect sedimentation and sediment transport in Powers Gulch. Potential long-term sedimentation impacts would be less than proposed action.	Sedimentation impacts during operation would be similar to proposed action. Increased sedimentation would occur in localized areas of Powers Gulch and Pinto Creek during postclosure.

**Table 2.16-f. Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation
Aquatic Biology (continued)**

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads		No Action
		Access Road Alternative A	Access Road Alternative B	
Loss of habitat (approximately 1.24 acres in Pinto Creek and 0.84 acre in Powers Gulch) from stream diversions. These habitat reductions would affect fish and invertebrate populations in Pinto Creek and invertebrate populations in Powers Gulch.	Reduction in ground water withdrawal from well field, thereby reducing associated impacts to surface flows and aquatic habitat.	Removal of approximately 4 acres of partially reclaimed riparian vegetation could reduce streambank stability and increase localized sedimentation, thereby reducing quality of habitat for longfin dace and desert sucker.	Similar to sedimentation impacts listed for road construction component of proposed action.	Continuation of existing aquatic conditions.
Dewatering of Carlota/ Cactus pit could affect aquatic habitat in Pinto Creek.	Reduction in ground water withdrawal from well field, thereby reducing associated impacts to surface flows and aquatic habitat.			
Potential decreases in streamflow from water supply well pumping could reduce flows in Haunted Canyon and Pinto Creek, which could decrease available habitat for aquatic communities, including longfin dace and desert sucker.	Potential water quality effects on aquatic communities due to spills or leaks from the low-quality water pipeline and storage facilities.			
Potential toxic effects of heavy metals and reduced pH on aquatic biota from low risk of accidental discharge of mine solutions and materials.	Potential temporary increase in sedimentation from pipeline construction.		Moderate direct and indirect impacts to longfin dace and desert sucker from sedimentation.	

Table 2.16-g. Summary Comparison of Impacts Between the Proposed Action and Alternatives without Mitigation Threatened, Endangered, and Sensitive Species

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
<p>Loss of 23.9 acres of occupied habitat and 237.6 acres of potential habitat for the Arizona hedgehog cactus.</p> <p>Potential impacts on lowland leopard frog in Powers Gulch, Haunted Canyon, and Pinto Creek from temporary sedimentation, dewatering, and potential spills or leaks into the streams.</p> <p>Potential effects on common black-hawk and yellow-billed cuckoo from loss of riparian vegetation.</p> <p>Desert sucker and longfin dace habitat in Haunted Canyon and Pinto Creek could be affected by temporary, localized increases in sedimentation from construction activities.</p> <p>Operational impacts on desert sucker and longfin dace would include potential habitat reductions from dewatering and potential metal toxicity and reduced pH from accidental releases of contaminants into Haunted Canyon and Pinto Creek.</p>	<p>Increase in sedimentation and potential water quality impacts to existing desert sucker, longfin dace, and lowland leopard frog populations.</p>	<p>Similar to pit backfill component of proposed action in terms of temporary sedimentation and potential water quality impacts from runoff on existing desert sucker, longfin dace, and lowland leopard frog populations, and potential Gila topminnow habitat.</p>	<p>Backfilling Eder South pit would create additional potential habitat for Arizona hedgehog cactus recolonization.</p>	<p>Loss of approximately 20 acres of occupied Arizona hedgehog cactus habitat.</p> <p>Potential effect on common black-hawk through increased indirect impacts to amphibian food sources and riparian habitat.</p> <p>During postclosure, increased sedimentation may affect existing desert sucker, longfin dace, and lowland leopard frog populations, and potential Gila topminnow habitat.</p> <p>Increased risk of potential accidental spills into Powers Gulch from slope instability would result in degraded water quality that could affect existing desert sucker, longfin dace, and lowland leopard frog populations.</p>

Table 2.16-g. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation Threatened, Endangered, and Sensitive Species (continued)

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells		Water Supply Well Field Access Roads		No Action
			Access Road Alternative A	Access Road Alternative B	
<p>Loss of 23.9 acres of occupied habitat and 237.6 acres of potential habitat for the Arizona hedgehog cactus.</p> <p>Potential impacts on lowland leopard frog in Powers Gulch, Haunted Canyon, and Pinto Creek from temporary sedimentation, dewatering, and potential spills or leaks into the streams.</p>			<p>Removal of approximately 4 acres of partially reclaimed riparian vegetation could reduce streambank stability and increase localized sedimentation, thereby reducing the quality of habitat for lowland leopard frog, longfin dace, and desert sucker. Impacts to amphibian population would affect food source for common black-hawk.</p>	<p>Similar temporary sedimentation impacts listed for the road construction component of proposed action.</p>	<p>Existing conditions would be maintained.</p>
<p>Potential effects on common black-hawk and yellow-billed cuckoo from loss of riparian vegetation.</p>			<p>Removal of approximately 4 acres of partially reclaimed riparian vegetation could reduce streambank stability and increase localized sedimentation, thereby reducing the quality of habitat for lowland leopard frog, longfin dace, and desert sucker. Impacts to amphibian population would affect food source for common black-hawk.</p>	<p>Similar temporary sedimentation impacts listed for the road construction component of proposed action.</p>	
<p>Desert sucker and longfin dace habitat in Haunted Canyon and Pinto Creek could be affected by temporary, localized increases in sedimentation from construction activities.</p>	<p>Potential temporary sedimentation and water quality impacts on fish and amphibian species from pipeline construction and accidental releases of low-quality water.</p>		<p>Removal of approximately 4 acres of partially reclaimed riparian vegetation could reduce streambank stability and increase localized sedimentation, thereby reducing the quality of habitat for lowland leopard frog, longfin dace, and desert sucker. Impacts to amphibian population would affect food source for common black-hawk.</p>	<p>Similar temporary sedimentation impacts listed for the road construction component of proposed action.</p>	
<p>Operational impacts on desert sucker and longfin dace would include potential habitat reductions from dewatering and potential metal toxicity and reduced pH from accidental releases of contaminants into Haunted Canyon and Pinto Creek.</p>	<p>Slight flow increase in Pinto Creek drainage since water would be taken from a source outside this drainage.</p>				

Table 2.16-h. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Cultural Resources

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	Eder Side-Hill Leach Pad Alternative
Construction and operational activities would directly affect 56 prehistoric and historic sites; 12 would be indirectly affected by increased human activity and erosion.	This alternative would affect 4 additional cultural sites (2 direct impact and 2 indirect impact).	This alternative would not affect any cultural sites, which would be the same as the proposed action.	Additional backfill of Eder South pit would indirectly affect 1 cultural site, which would be the same as the proposed action.	This alternative would affect 35 cultural sites (19 direct impacts and 16 indirect impacts), which would be the same as the proposed action.
Thirty-five of the 56 direct impact sites meet eligibility criteria for the NRHP; 8 of 12 indirectly affected sites also meet these criteria.				

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads	
		Access Road Alternative A	Access Road Alternative B
Construction and operational activities would directly affect 56 prehistoric and historic sites; 12 prehistoric and historic sites may be indirectly affected by increased human activity and erosion.	No sites would be affected, resulting in a decrease of 10 sites compared to the proposed action.	This alternative would indirectly affect 1 site, resulting in an increase of 1 site compared to the proposed action.	This alternative would indirectly affect 1 site, resulting in an increase of 1 site compared to the proposed action.
			No Action Existing conditions would be maintained.

Table 2.16-i. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Socioeconomics

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
<p>Slight increases in population growth (<1 to 3.6 percent) in nearby communities would result from construction (temporary) and operation workforces.</p> <p>Substantial beneficial increase in temporary employment for construction (177 workers) and permanent employment for project operation (282 to 301 workers).</p> <p>Increase in demand for temporary and permanent housing during construction and operation phases. Inadequate supply would limit housing availability.</p> <p>Demand for public services would increase in the Globe-Miami and Superior areas. Existing public services would be adequate for increased growth, except for the municipal water supply in Miami and law enforcement requirements by the Gila County Sheriff's Department.</p> <p>Project-related growth would not adversely impact schools. Slight staffing increases may be needed.</p> <p>No substantial change in property values would be expected.</p> <p>Beneficial increase in economic base for mining compared to present base dominated by ranching and recreation.</p> <p>Substantial beneficial increase in annual tax revenues from the project expenditures and property taxes.</p> <p>No major adverse impacts would occur in lifestyles, social organization, attitudes, beliefs, or values because of the project.</p>	<p>Similar to relevant portion of proposed action.</p>	<p>Workforce of 190 for additional 3 or 4 years.</p>	<p>Workforce of 190 for additional 2-3 months.</p> <p>Additional property tax revenues would be generated for Pinal and Gila Counties and the Miami Unified and Superior Unified School Districts.</p>	<p>Similar to leach pad component of proposed action.</p> <p>Property values at Top-of-the-World area may be adversely affected by increased noise and visual impacts.</p> <p>Project costs would increase with this alternative.</p>

Table 2.16-i. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation Socioeconomics (continued)

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells		Water Supply Well Field Access Roads		No Action
			Access Road Alternative A	Access Road Alternative B	
Slight increases in population growth (<1 to 3.6 percent) in nearby communities would result from construction (temporary) and operation workforces.			Similar to access road components of proposed action.	Similar to access road components of proposed action.	No beneficial economic employment impacts would occur. No adverse impacts on housing demand and public services would occur.
Substantial beneficial increase in temporary employment for construction (177 workers) and permanent employment for project operation (282 to 301 workers).					
Increase in demand for temporary and permanent housing during construction and operation phases. Inadequate supply would limit housing availability.					
Demand for public services would increase in the Globe-Miami and Superior areas. Existing public services would be adequate for increased growth, except for the municipal water supply in Miami and law enforcement requirements by the Gila County Sheriff's Department.					
Project-related growth would not adversely impact schools. Slight staffing increases may be needed.					
No substantial change in property values would be expected.					
Beneficial increase in economic base for mining compared to present base dominated by ranching and recreation.					
Substantial beneficial increase in annual tax revenues from the project expenditures and property taxes.	Addition of water pipeline would increase project costs, which would increase assessed valuation and total property tax revenues in the region.				
No major adverse impacts would occur in lifestyles, social organization, attitudes, beliefs, or values because of the project					

Table 2.16-j. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Land Use

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
<p>Project would be consistent with mineral management objective in <i>Tonto National Forest Plan</i>.</p> <p>No change in land status or ownership.</p> <p>Existing permit to Salt River Project would be amended to include new powerline and substation; new permits would be required for water and power facility sites or corridors; amendments to existing grazing permits would be required; permit(s) for fuel wood salvage would be required; possible State permits would be required for salvage or relocation of protected species. No modification required to <i>Tonto National Forest Plan</i>.</p> <p>Land use changes would include increase in mining activity and reduction in grazing (1,500 acres), and elimination of horseback riding and hiking along Powers Gulch to access Haunted Canyon Trail.</p> <p>Degradation of recreational experience of hikers and horseback riders, and increased vehicle use on Forest Service Trail 203.</p>	<p>Land use change would occur on additional 22 acres in Tonto National Forest and 22 acres on private land.</p>	<p>Additional backfilling would increase area to be reclaimed by approximately 153 acres.</p>	<p>Additional reclaimed area for Eder South pit would be 16 acres. Reclaimed area for Eder rock disposal area would increase by 33 acres from approximately 40 to 73 acres.</p>	<p>Similar to leach pad component of proposed action, but additional 134 acres would be disturbed adjacent to Powers Gulch.</p>

Table 2.16-j. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation Land Use (continued)

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells		Water Supply Well Field Access Roads		No Action
			Access Road Alternative A	Access Road Alternative B	
<p>Project would be consistent with mineral management objective in <i>Tonto National Forest Plan</i>.</p> <p>No change in land status or ownership.</p> <p>Existing permit to Salt River Project would be amended to include new powerline and substation; new permits would be required for water and power facility sites or corridors; requires amendments to existing grazing permits would be required; permit(s) for fuel wood salvage would be required; possible State permits would be required for salvage or relocation of protected species. No modification required to Tonto National Forest Plan.</p> <p>Land use changes would include increase in mining activity and reduction in grazing (1,500 acres), and elimination of horseback riding and hiking along Powers Gulch to access Haunted Canyon Trail.</p> <p>Degradation of recreational experience of hikers and horseback riders, and increased vehicle use on Forest Service Trail 203.</p>	<p>Construction of water pipeline, pumping stations, access roads, and power lines would result in additional land use changes.</p>		<p>Similar to access road component of proposed action.</p>	<p>Similar to access road component of proposed action.</p>	<p>Existing land uses would be maintained.</p>

Table 2.16-k. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Recreation

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
	Similar to mine rock disposal components of proposed action.	Similar to pit backfill component of proposed action.	Similar to Eder backfill component of proposed action.	
<p>The proposed action would result in impacts to dispersed recreational activities or facilities, such as horseback riding access to Haunted Canyon and Superstition Wilderness via Powers Gulch, hunting, and four-wheel driving.</p> <p>Minor increases in recreation visitor days and use of local community recreational facilities because of population growth.</p> <p>Adverse effects on recreational activities or experience because of increased use, land disturbance, aesthetic effects, or increased noise levels. Some of the area would remain unusable after reclamation.</p> <p>Change in ROS of 1,892 acres from "Roaded Natural Area" to "Urban" because of mining.</p>				Dispersed recreational activities would decrease in additional area disturbed (134 acres) near Powers Gulch.

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads		No Action
		Access Road Alternative A	Access Road Alternative B	
	Similar to water supply components of proposed action.	Recreational access would be improved by alternative access road.	Recreational access would be improved by alternative access road.	
<p>The proposed action would result in impacts to dispersed recreational activities or facilities, such as horseback riding access to Haunted Canyon and Superstition Wilderness via Powers Gulch, hunting, and four-wheel driving.</p> <p>Minor increases in recreation visitor days and use of local community recreational facilities because of population growth.</p> <p>Adverse effects on recreational activities or experience because of increased use, land disturbance, aesthetic effects, or increased noise levels. Some of the area would remain unusable after reclamation.</p> <p>Change in ROS of 1,892 acres from "Roaded Natural Area" to "Urban" because of mining.</p>		Adverse impacts would occur for hikers and horseback riders from increased noise and visual effects from traffic.	Adverse impacts would occur for hikers and horseback riders from increased noise and visual effects from traffic.	Existing recreational activities and opportunities would be maintained.

**Table 2.16-I. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Wilderness & Wild and Scenic Rivers**

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Access to Superstition Wilderness area via horseback along Powers Gulch would be reduced.	Similar to mine rock disposal components of proposed action.	Similar to pit backfill component of proposed action.	Similar to Eder pit backfill component of proposed action.	Greater risk of catastrophic impacts to downstream water quality.
Potential noise impact on eastern edge of Superstition Wilderness.				
Minor increase in recreational use in Superstition and Sierra Ancha Wildernesses.				
A catastrophic event could affect water quality in this reach of Pinto Creek. If water quality conditions decline, this reach could become ineligible for Wild or Scenic designation.				
No major adverse effects on scenic, riparian, and ecological values for Pinto Creek segment eligible for Scenic status. Small potential reduction in surface flow due to pit dewatering and well field pumping.				

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads		No Action
		Access Road Alternative A	Access Road Alternative B	
Access to Superstition Wilderness area via horseback along Powers Gulch would be reduced.	Potential for reduced effects on the scenic and ecological values of Pinto Creek segment eligible for Scenic status.	Similar to access road component of proposed action.	Similar to access road component of proposed action.	Wilderness and values for Scenic designation would be maintained.
Potential noise impact on eastern edge of Superstition Wilderness.				
Minor increase in recreational use in Superstition and Sierra Ancha Wildernesses.				
A catastrophic event could affect water quality in this reach of Pinto Creek. If water quality conditions decline this reach could become ineligible for Wild or Scenic designation.				
No major adverse effects on scenic, riparian, and ecological values for Pinto Creek segment eligible for Scenic status. Small potential reduction in surface flow due to pit dewatering and well field pumping.				

Table 2.16-m. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation
Visual Resources

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Visual effects would include moderate short-term impacts from U.S. Highway 60, low short-term impacts from the Superstition Wilderness viewpoints, and moderate to high short-term impacts from Top-of-the-World viewpoint (ridge north of subdivision). Impacts would comply with Visual Quality Objectives at all viewpoints except Top-of-the-World. Minor visual effects from light spill and glare during nighttime operation from all viewpoints.	Minor visual impacts from sites from all viewpoints.	Although height of Main mine rock area would be reduced, visual impacts would not be measurably reduced.	Removal of Eder mine rock disposal area would reduce visible extent of disturbed areas, and view of background would be opened.	No visual impacts from U.S. Highway 60 viewpoint. Minor visual impacts from Superstition Wilderness viewpoint.
		Although height of Main mine rock area would be reduced, visual impacts would not be measurably reduced.		High short- and long-term visual impacts from Top-of-the-World viewpoint.
		Although height of Main mine rock area would be reduced, visual impacts would not be measurably reduced.		

Proposed Action	Water Supply Alternatives Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads	No Action
		Access Road Alternative A	
Visual effects would include moderate short-term impacts from U.S. Highway 60, low short-term impacts from the Superstition Wilderness viewpoints, moderate to high short-term impacts from Top-of-the-World viewpoint (ridge north of subdivision). Impacts would comply with Visual Quality Objectives at all viewpoints except Top-of-the-World. Minor visual effects from light spill and glare during nighttime operation from all viewpoints.	Minor visual impacts from all viewpoints.	Reduced visual impacts from all viewpoints, since road would follow an existing road in bottom of drainage.	Except for a small area near confluence of Haunted Canyon and Powers Gulch, this alternative would not be visible from any commonly used viewpoints.
		Existing visual conditions would be maintained.	

Table 2.16-n. Summary Comparison of Impacts Between the Proposed Action and Alternatives Without Mitigation Noise

Proposed Action	Mine Rock Disposal Alternatives			
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
Project-generated noise could exceed ambient background levels along a portion of the eastern boundary of Superstition Wilderness for duration of project.	Project-related noise levels would be slightly reduced since rock dumps would be located farther from Superstition Wilderness and Top-of-the-World. However, noise levels would still exceed background levels at Wilderness boundary and would be within acceptable levels at the community.	Project-related noise levels would be slightly increased because of additional material handling and transporting. However, impact conclusions would be similar to proposed action.		Similar to leach pad component of proposed action.
Project-generated noise at Top-of-the-World would be less than acceptable Housing and Urban Development noise standard (65dBA) for residential areas for duration of project.	Project-related noise levels would be slightly reduced since rock dumps would be located farther from Superstition Wilderness and Top-of-the-World. However, noise levels would still exceed background levels at Wilderness boundary and would be within acceptable levels at the community.	Project-related noise levels would be slightly increased because of additional material handling and transporting. However, impact conclusions would be similar to proposed action.	Project-related noise levels would be slightly increased because activity would be closer to Top-of-the-World. However, levels at the community would still be within acceptable standard. Impacts on Wilderness would be similar to proposed action.	

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads	
		Access Road Alternative A	Access Road Alternative B
Project-generated noise could exceed ambient background levels along a portion of the eastern boundary of Superstition Wilderness for duration of project.	Minor additional noise impacts would result, mainly during construction.	Relatively small noise impacts similar to access road construction component of proposed action.	Relatively small noise impacts similar to access road construction component of proposed action.
Project-generated noise at Top-of-the-World would be less than acceptable Housing and Urban Development noise standard (65dBA) for residential areas for duration of project.	Minor additional noise impacts would result, mainly during construction.	Relatively small noise impacts similar to access road construction component of proposed action.	Relatively small noise impacts similar to access road construction component of proposed action.
			No Action Continuation of existing noise levels.

Table 2.16-o. Summary of Comparison Impacts Between the Proposed Action and Alternatives Without Mitigation Transportation

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative Eder Side-Hill Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pit	
Increased vehicle use on U.S. Highway 60 would not result in major change in traffic number, Level of Service criteria, and safety conditions. Commercial transportation may benefit from increased population base and increased business activity. Closing portions of Forest Service Road 898 would conflict with Resource Access Travel Management Plan.	No effect on transportation off the site.	No effect on transportation off the site.	No effect on transportation off the site.	No effect on transportation off the site.

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads	No Action
		Access Road Alternative A	Access Road Alternative B
Increased vehicle use on U.S. Highway 60 would not result in major change in traffic number, Level of Service criteria, and safety conditions. Commercial transportation may benefit from increased population base and increased business activity. Closing portions of Forest Service Road 898 would conflict with Resource Access Travel Management Plan.	No effect on transportation off the site.	No effect on transportation off the site; would affect longer segment of Forest Service Trail 203.	No effect on transportation off the site.

Table 2.16-p. Summary of Comparison Impacts Between the Proposed Action and Alternatives Without Mitigation Hazardous Materials

Proposed Action	Mine Rock Disposal Alternatives			Leach Pad Alternative
	Alternative Mine Rock Disposal Sites	Additional Backfill of Carlota/Cactus Pit	Additional Backfill of Eder South Pits	
Potential impacts to environmental resources from accidental release of hazardous materials during transportation to project area or storage and use at the site.	No additional impacts on environmental resources.	No additional impacts on environmental resources.	No additional impacts on environmental resources.	Eder Side-Hill Leach Pad Alternative No additional impacts on environmental resources.

Proposed Action	Water Supply Alternative Low-Quality Water, Water Supply Wells, and Dewatering Wells	Water Supply Well Field Access Roads	
		Access Road Alternative A	Access Road Alternative B
Potential impacts to environmental resources from accidental release of hazardous materials during transportation to project area or storage and use at the site.	No additional impacts on environmental resources.	No additional impacts on environmental resources.	No additional impacts on environmental resources.
			No Action No use of hazardous materials.

